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METHODS AND TECHNIQS OF EDUCATIONAL RESEARCH

AMERICAN EDUCATIONAL RESEARCH ASSOCIATION

A Department of the

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AMERICAN EDUCATIONAL RESEARCH ASSOCIATION

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FOREWORD

IT was the original plan to have the review of methods of research prepared as a committee report. This proved to be a more formidable task than was at first realized. It seemed to require the type of cooperation through committee meetings for which neither the requisite time nor money were available. Accordingly, the plan was hit upon of asking the chairman of each subject committee to prepare a chapter on the methods of research in his own field. It was a good deal to ask the chairmen to do, at short notice, on top of the arduous labor of preparing the reviews of research themselves; but they have responded nobly, and I am not sure but that the present type of review of methods is more useful than the type which was originally planned. At least, I think it will be found more useful to practical workers in the respective fields.

This survey of methods will, I believe, be found particularly helpful as a guide and source of suggestions regarding methods of attack on specific problems. It will help the research worker to discriminate between sound and unsound methods. This will be particularly valuable to the administrator or teacher who has not had extensive experience in research but wishes to make an occasional study, as well as to the student in training for research.

FRANK N. FREEMAN,
Chairman of the Editorial Board.

CHAPTER I

Research and Various Approaches to Curriculum Building

DURING the decade preceding the depression there was greater activity in the field of curriculum revision than at any previous time in history. Even within the period of 1928-1930, courses of study were revised in whole or in part in thirty-one states. Curriculum revision has been most active at the elementary school level. An analysis made by the Curriculum Construction Laboratory of Teachers College, Columbia University, of 30,455 courses of study shows that 74 percent have been made for elementary schools, while 13 percent have been made for junior high schools, and 12 percent for senior high schools. The Thirty-first Yearbook of the National Society for the Study of Education (37) showed that much revision has been going on at the college level. Peik's analytical studies (39, 40, 47) of courses in education, to cite one example, illustrated a technic of investigation that has wide usefulness over the whole college curriculum. Meiklejohn (36) showed how the curriculum for one experimental college was developed and offered many suggestions for curriculum building at the college level.

The present period offers excellent opportunity to review and evaluate previous and present methods of research in curriculum building, to offer suggestions for extension of methods now in use, and to define new problems for research.

Problems of curriculum research are so closely tied up with one's basic philosophy of education, with one's ideas on sociology, economics, and psychology, that brief mention must be made of these factors as a background for discussing methods of research in curriculum building. The basic philosophy which one holds naturally determines not only his approach to curriculum building and the research problems which he undertakes, but it also influences his interpretation of the findings of his research studies.

For example, take the question of adult needs vs. child interests. Horn (26) writes: "Whoever is concerned in the education of children must have in mind the permanent and important needs of adult life. On the other hand, the present needs of children, both in and out of school, must be considered also."

Bobbitt (6:8) states emphatically: "Education is primarily for adult life, not for child life. Its fundamental responsibility is to prepare for the fifty years of adulthood, not for the twenty years of childhood and youth."

In a later statement Bobbitt (7:43) says:

At no time and in no degree is the present to be sacrificed for the future. We do not look forward to the future for the sake of preparing for it; but only for assistance in holding high the current living. Education is not primarily to prepare for life at some future time. Quite the reverse; it purposes to hold high the current living, making it wholesome, intense, abundant, fruitful, and fitting it firmly into the grooves of habit. Only thus can high-grade living be given that momentum that will carry it through to the end.

Kilpatrick (31:411) writes:

We must then as regards the younger years cease to think of schooling as primarily a period of preparation for later years, but think rather of life as one continuous whole with education as the name we give to the continuing process of building up and refining the organism through ever new and more delicately adequate behavior, a process continuing throughout life and capable of being so directed at each successive stage as to make finer and better the succeeding stages.

Where the adult needs approach is carried to the extreme, the interests of children are respected only where they coincide with the interests of adults. One writer suggests that totally disregarding child interests is like cutting off the polliwog's tail because no frog needs one. Most curriculum builders are coming to recognize that consideration should be given to both child experiences and the needs of society.

Then there is the question: What is the task of education in a period of rapid social change? Bagley (3:568) answers:

... the most important function of education in such a period is a stabilizing function. The very time to avoid chaos in the schools is when something akin to chaos rages in the social environment. The very time to emphasize in the schools the values that are relatively stable and abiding is when the social environment is full of uncertainty and when standards are crumbling.

Kilpatrick (29:48), on the other hand, writes:

... we must all together study our social problems until we become fired with zeal for the cause of a better social day. We must commit ourselves and our work intelligently to the cause of the public welfare, not in lip service, but in appropriate and effectual endeavor. . . . We must mean to help society, . . . to move along most defensible lines to the ever emerging best social goals.

Among the major variables to be reckoned with in curriculum building are: (1) a constantly increasing body of knowledge from which to select the content of courses of study; (2) a changing social order to which we must relate what we select; and (3) a student body of varying ages, stages of development, intellectual capacities, social and economic backgrounds, present interests, and future plans—to which the curriculum must be adapted, graded, and differentiated. The degree to which these three variables have been recognized has largely determined the different approaches which different people have made in selecting the materials of instruction.

Bruner (10) included these thirteen approaches to curriculum construction:

- | | |
|----------------------------|-----------------------------|
| 1. Present practice | 8. Social statistics |
| 2. Child experience | 9. Educational shortages |
| 3. Creative values | 10. Emotionalized attitudes |
| 4. Adult needs | 11. Activity analysis |
| 5. Frontier thinkers | 12. Objectives |
| 6. Socio-economic approach | 13. Scientific approach |
| 7. Social values | |

In listing these thirteen approaches, Bruner writes: "It is obvious that some of the various phases of the approaches overlap others, and in some cases each does not constitute an entirely separate approach."

This long list may not be entirely satisfactory to the person responsible for a particular program of curriculum revision in a particular city in that it may appear to overlap too much and be too detailed; he may want to reduce it by grouping together several similar approaches. Norton (38:170-72), for example, grouped the various approaches to the selection of curriculum content under three heads: (1) the approach which emphasizes the conservation of elements already found in the traditional curriculum; (2) the approach which seeks to discover what to select from the traditional curriculum; and at the same time strives to add new material appropriate to contemporary life; and (3) the approach which reappraises the material of the traditional curriculum, discovers new material appropriate to contemporary life, and in addition seeks to add content which promises to guide the development of life in the direction of social advance.

For the purpose of reviewing methods of curriculum research, Bruner's long list of approaches to curriculum and course of study construction (10) is helpful in that it offers opportunity to show in more detail the great variety of research studies which have been made to solve problems of selection and grade placement of curriculum content. Hence Bruner's tentative list, with some modifications, will be followed here; other approaches will be added; and brief mention will be made of each approach, including citations to research studies which illustrate it. Only enough studies will be cited to serve as examples, since this article is intended to orient one in the whole field of curriculum construction, rather than to examine in detail specific technics. This orientation should be suggestive in connection with the April, 1934 issue of the *Review of Educational Research*, which will present a wealth of illustrative types of research in curriculum revision.

Present Practice

In this approach, some are guided by the median of current practice, others set up criteria for selecting courses of study which represent the best of current practice, and choose those topics which have the greatest frequency of mention in the group of selected "best" courses. Mann (34), Stratemeyer and Bruner (52), and Curtis (16) have published studies which illustrate this approach to curriculum building.

Those who accept the median of current practice as their guide hold that course of study building is a progressive development or a "sifting process," and that each time a course of study is built, it represents the selection of what educators at that time considered the most valuable material. Those opposed to this procedure argue that it is not always wise to follow present practices and particularly the median of many discordant practices of school systems which are the result of different ideas of what education is and ought to be.

The procedure of selecting topics on the basis of their frequency of mention in a list of selected "best" courses has in its favor the intent eventually to pull up all school practice everywhere to the level of what now, by carefully selected criteria, are considered the best practices, and this would be a tremendous advance. Those who are critical of this approach maintain that it adds nothing to what already exists somewhere in some progressive schools. It is a method of distributing the good rather than augmenting the actual present possessions of the schools.

Child Experience

According to Kilpatrick (30) the conception of the whole child, all sides of life integrated within an effective growing whole, must dominate our every endeavor in school work. He conceives the curriculum as a succession of educative experiences considered with reference to the accumulating educative effect, i.e., either as growing personality or as increasing power and control. Rugg and Shumaker (48) are among those who have appraised this new education.

Researches which illustrate the child experience approach to curriculum building include studies of children's interests and needs in various fields at different ages and experimental units designed to develop personality and individuality. Many illustrations of the latter have been collected by Carey, Hanna, and Meriam (11).

Freeman (19), in answer to the question, "Should the curriculum be built on children's interests or social needs?" writes:

Perhaps, and quite likely, both extreme positions are wrong. The real difficulty [with the curriculum built wholly on social needs] is that the child is supposed to do things that have no meaning for him. The dietitian has a lesson for the educator. Knowing what foods are best for the child, educators do not try to compel him to eat them as the parents often do. They try to appeal to the child's appetite. The expert has learned to make the child like what he should. . . . The expert goes further. He makes it graphically clear to the child what is to be gained by eating the proper food.

Creative Values

There are those who believe that the way to wisdom and enlarged living is through a broad cultivation of spiritual and creative powers. Mearns (35), for example, writes that:

Creative power, which is the aim of educational achievement, may easily eventually be directed to the securing of all the information and skills needful for life and living, and that it also may be led to those heights among the intangibles of appreciation and culture which curricular instruction so regularly missed.

Those who use this approach to curriculum building seek to capitalize the natural creative impulses of children. *Creative Expression* (46), which deals with the development of children in art, music, literature, and drama, gives special emphasis to the child's own modes of self-expression through all of the creative arts, as opposed to adult standards.

Some even go so far as to suggest that the curriculum should not be made in advance, but should develop from day to day, according to the child's interests and needs.

Some criticize this approach to curriculum building on the basis that it requires artist teachers of which there is a lack and that it often fails to capitalize adult experience. They hold that to leave the child entirely free to select his school activities is to throw on him a burden that he does not deserve. Adults have experience to fall back on, mature judgment, and the guidance of frontier thinkers as to major issues in contemporary life. But even they require the authority of law and of convention. However, the critics of the creative values approach to curriculum revision admit that authority over children should not mean tyranny. It should not deny them the right of individual choice and expression under wise guidance. Children are miserable when they are not left to their own modes of self-expression at least part of the time, and when they are under the oppression of subject-matter in which they see no value, or which they cannot master.

Frontier Thinkers

Those who use this approach to curriculum and course of study construction assume that the best source for the statement of insistent and persistent contemporary problems is the published works of the so-called "frontier thinkers." Specialists, who have devoted years not only to the detailed intensive study of the theoretical aspects of their specialties, but who, in many cases, have become practically acquainted with these problems in the field, are considered by research workers, who accept this approach to curriculum building, to be best qualified to give an insight into, and a more mature judgment concerning, the issues of present-day life.

The published writings of these men, rather than personal interviews, are usually selected for analysis, since they afford a more convenient basis for discovering these problems, and because published writings usually tend to be more critical than the opinions that one would get from personal or oral interviews with them.

By this method the school curriculum is extended beyond what was formerly known to teachers.

Research studies illustrative of this approach to curriculum building include those by Rugg (50), Billings (5), Hockett (24), and Lee (32).

In so far as the writings selected for analysis deal with social issues which are of vital significance, this approach to curriculum building is valid. After discovering these issues, there remains the difficult task of selecting suitable materials bearing upon them, as well as the question of grade placement. The final step in this approach is to subject the materials, which have been developed, to school experiments and to tests which will reveal their suitability. In the future, this method of utilizing the schools as centers for the refinement of material secured from outside the regular school programs, will doubtless be used far more extensively.

Socio-economic Approach

Since the onset of the depression, this approach has received special emphasis. The new Virginia state course of study in the social studies is an illustration of a course which includes this approach among others. This approach seeks to develop a deeper and personal knowledge and understanding of some of the most pivotal world problems. The approach calls for a study of social and economic problems not only in books, magazines, and newspapers, but also in each local community. Studies of local housing conditions, food and clothing supplies, communication and transportation facilities, for example, lead into questions of human relations, distribution of wealth, marketing, and interdependence.

Among the studies which are usable in this approach to curriculum building are Chase's *Men and Machines* (14), Lynd and Lynd's *Middletown* (33), Rugg's *The Great Technology* (49), and the report on *Recent Social Trends in the United States* (45).

This approach, as did the preceding one, emphasizes the relation of life in the school to the social life in the world at large. The source of the new materials is the social and economic life outside the school. School experiments and tests are used to show how successful the selection of the new materials has been.

Few would object to the socio-economic approach to curriculum building, provided it is supplemented by three interrelated lines: (1) aesthetic and spiritual values must not be lost sight of; (2) the basic institutions need to project themselves into the near future to predict what changes will take place in life conditions; and (3) emphasis of training must be placed upon the development of an integrated personality that will be able to meet present and future conditions of human environment.

Closely allied to the socio-economic approach to curriculum construction, if not a part of it, is the social statistics approach, which evaluates social statistics, bearing on many areas of life. Studies such as the following are usable in this approach: *Medical Care for the American People* (42), certain of the White House Conference reports (53); *Recent Economic Changes in the United States* (44), certain reports of the President's Conference on Home Building and Home Ownership (43), *The Modern American Family* (55), *The Reading Interests and Habits of Adults* (20), and the *Education of the Consumer* (22). Statistics as to the number of workers needed in various fields will in the future doubtless largely determine the number to be trained. Just as social planning, legislation, and various governmental departments are relying more and more on social statistics, so in the future will the curriculum builder use them as one approach to curriculum building.

Present Social Values

Those who use this approach emphasize immediate social utility in the selection of curriculum content. They are constantly seeking to discover what knowledge and skills are most needed in present-day life outside the

school, rather than in life as it may be or should be in the future as forecasted by "frontier thinkers."

Illustrative research studies are Horn's word counts (25) to discover the words most frequently used in business and social correspondence; Wilson's survey (54) of the social and business usage of arithmetic; Bowden's study (8) of arithmetic, based on an analysis of newspapers and a study of details of the various occupations; and Finley and Caldwell's study (18) of biology in the public press to determine what knowledge of biology is essential to read current newspapers and magazines intelligently. The National Council of English Teachers (51) also made use of the social values approach to curriculum construction when it secured the judgments of nearly 8,000 persons engaged in various vocations and professions, as to the language skills necessary for ordinary success in life.

Intelligently used, this approach will keep the curriculum abreast of the times, or at least not very far behind. It provides for the reasonably prompt elimination of obsolete material and its replacement by that which is modern and consistent with the practical needs of current life.

Critics of this method say that its weakness, particularly if it is the sole basis of curriculum construction, is that it makes the school a follower, rather than a prophet of social evolution. Whether its ultimate contribution is positive or negative depends upon the direction which life takes as influenced by factors outside the school. In its pure form this type of curriculum construction might act to make the school hasten social degeneration as readily as to contribute to social advance.

Educational Shortages

Those who advocate this approach feel that valid criticisms of present courses of study should be among the guides used in course of study reconstruction. Dulebohn (17), for example, in his analysis of civic and social shortcomings as curriculum indices, sought to find everything pointed to as undesirable in the editorials of nine newspapers and six magazines over a considerable period of time. The shortcomings discovered were classified into four groups: deficiencies of (a) the private citizen, (b) various governmental units, (c) certain social groups, and (d) officials. Bagley's study (2) of education, crime, and social progress involved (a) an identification of the elements of weakness in American education and (b) an effort to replace these with elements of strength. Coe (15) analyzed the moral shortcomings of youth and the program of the schools, and suggests that the former are a reflection of corresponding faults in the latter.

Studies of children's errors or shortcomings in specific subjects are also used in developing courses in these subjects. For example, Harap's composite study (21) of thirty-three previous investigations of grammatical errors made by pupils offers definite suggestions for developing a course of study in grammar. Like lists of "spelling demons," such studies also aid in deter-

mining where the greatest emphasis should be placed; since, frequency of error is to some extent a measure of the difficulty or ease of learning.

While many might argue that the educational shortages approach would not always develop a complete course of study, few would deny that it aids in showing where to place emphasis.

Emotionalized Attitudes

According to Briggs (9), we feel more than we think, and fixed attitudes are always charged with emotions to a greater or less degree. These emotionalized attitudes stimulate one to action, condition his reception and interpretation of facts, and are influential in integrating the members of a group. Hence they should be of real concern to curriculum makers. Research studies show that the way in which courses are taught is quite as important, if not more so, in the development of emotionalized attitudes as are the courses themselves. Barnesberger (4), for example, found that an activity program is productive of more outside reading, more new interests, and more ongoing enterprises.

Activity Analysis

Charters (12) and other curriculum builders who use this approach feel that curriculum content should originate in the problems, activities, and interests of modern life. Activity or job analysis makes selection objective since it provides a clear picture of the substantial bases of selection. It asks in detail what traits and what information are necessary for success in particular situations in life. Activity analysis provides a definite picture of the activities which are to be treated in books and courses of study. The occupational and job analysis approach is particularly helpful in developing a course of training for a particular occupation or job. The problem narrows down to an analysis of the major and minor duties of that job; the knowledge, habits, and skills for success in it; and the development of units of work which will equip the learner with them. The five methods used separately or in combination in making a job analysis include: introspection, interviewing people on the job, reading about the job, questionnaire, and working on the job.

An illustration of this approach to curriculum building is the *Commonwealth Teacher-Training Study* (13). This study is a thoroughgoing analysis of the activities of teachers. It includes a list of 914 duties. This long list was evaluated for frequency of performance, for difficulty of learning, and for importance. Charters' industrial analyses in Pittsburgh, his analysis of women's activities relative to the Stephens College curriculum, and his analyses of secretarial duties and traits are typical examples of the use of activity analysis in curriculum-making.

Objectives

This approach involves a statement of abilities and the selection of pupil experiences necessary to their acquisition. It offers, as a substitute for

activity analyses, the pooled judgment of thoughtful men and women as to the essential needs of adult life. According to this method, course of study committees make more or less comprehensive lists of human abilities and characteristics which in their judgment are advisable or desirable for men and women. This comprehensive list of abilities is determined wholly without reference to subjects or departments. It presents the characteristics and abilities needed by men and women of large natural ability. The list is cut down to meet the needs of those of lesser capacity. Bobbitt (6), for example, classified such a comprehensive list of abilities under ten major headings. After such a classification of abilities has been made, each department in the school system selects those toward the attainment of which it will direct its efforts. The next question faced is this: What are the activities and experiences on the part of the pupils which are necessary for achieving these objectives? The pupils' experiences and activities agreed upon are the curriculum. Pendleton's study (41) of the social objectives of English is an illustration of the objectives approach to course of study construction.

Many criticisms of this approach have resulted from objectives being stated in vague generalities, or being stated and then more or less ignored when subjectmatter was selected. Harap (23:128) points out that objectives should be so specific as to define with some exactness the scope of the teaching unit which is designed to achieve them. He holds that the inclusion of any unit of teaching material is justifiable only if it points to the achievement of some specific, useful purpose which should be stated at the beginning of each unit of instruction.

Social Heritage

Judd (27, 28), for example, would have the school curriculum include a study of the social contributions which various subjects have made. Using arithmetic as an illustration, he writes:

... society has been transformed in its ways of thinking and in its modes of behavior by the use of number. The history of human intellectual life shows that through long ages the human mind has been perfecting the number system and through all these ages men have learned progressively to depend on number for the regulation of their lives. There is a new kind of psychology in the world because the number system has become a common possession. . . . I find that the number system has given even to ordinary thinkers an attitude of precision in their thinking which is enormously more significant than the ability to add or subtract or perform any particular calculation.

According to this viewpoint, the pupil who is drilled in the use of number is acquiring a mode of thought which will change all of his later mental operations. Arithmetic is a general mode of thinking, not merely a tool. To reduce arithmetic to a few practical applications, such as some research studies suggest, would be to neglect the general idea of precise thinking on which our mechanical and scientific civilization rests.

Those who accept the social heritage approach to curriculum building hold that the chief duty of the school is not merely to train pupils in par-

ticular skills needed in the common affairs of life, but to cultivate comprehensive general ideas. According to Judd (28:323), for example, curriculum research workers "should study the trends of civilization. A trend is much more important to understand than is any particular content of thought or any particular skill. . . . Knowledge of a trend of civilization carries the educator forward. It gives him a standard of selection, a guiding principle." This approach, at its best, leans heavily on historical research.

The Committee on Materials of Instruction of the American Council on Education (1) has made use of this approach in preparing the Achievements of Civilization Series of basic school readings. This series is published "with a view to cultivating a wide acquaintance on the part of pupils with the indebtedness of present-day society to earlier cooperative human efforts." It includes the following titles to date:

1. *The Story of Writing*
2. *The Story of Numbers*
3. *The Story of Weights and Measures*
4. *The Story of Our Calendar*
5. *Telling Time throughout the Centuries*
6. *Rules of the Road.*

A Synthesis of Various Approaches

This would appear to be the most scientific attack on curriculum building, and is the one which is coming to be used most frequently.

For example, the studies most commonly used as bases for the selection of content of home economics courses are those which seek to discover:

1. The place of the home in modern civilization.
2. Trends in family life.
3. The objectives of home economics in a machine age.
4. Most common present-day practices and activities in various types of homes and communities.
5. What high school girls do at home.
6. What girls know before starting on a home economics course.
7. What supplementary home practices and knowledge may be acquired at home.
8. How interested are girls in home activities.
9. Analysis of strengths and weaknesses of best current courses.
10. Gaps in training reported by home-makers who have had home economics courses.
11. Probable changes in living conditions in the next decade.
12. What pupils should know and be able to apply at the completion of each year of work.

The more data that can be secured on all these points, and the more carefully they are evaluated and synthesized, the better will be the resulting course of study in home economics. In the same way, a variety of approaches must be made to course of study construction in practically every field. The curriculum must be as broad as life itself. There is no one approach to life which will give one a liberal understanding of its meaning. Similarly, there is no one type of investigation which will furnish an adequate basis for the determination of curriculum content.

All of the approaches, described and briefly illustrated in the foregoing paragraphs, when skillfully employed, yield findings which are helpful to the broad and practical student of curriculum revision. Some of the principal errors made in curriculum building result from a piecemeal approach, which emphasizes valuable, but at the most partial bases, for determining curriculum content—to the exclusion of other equally valuable bases.

The worth of the various approaches listed above differs markedly according to the educational philosophy lying back of, and the content and method entering into, a particular phase of the curriculum. To illustrate, a detailed activity analysis of shoe shining is extremely valuable, provided it has been decided that a portion of school time may be most advantageously used in equipping a youth with this particular vocational skill. Such an analysis is obviously valueless if the curriculum includes no provision for vocational training of this type. A discriminating analysis of some of the major trends of contemporary civilization is of great value to one who emphasizes contemporary social problems in the education of children. Such an analysis would be of less value to one who emphasizes the spontaneous interests of children as the primary basis on which to build a curriculum. It would be of even less value to one who puts greatest emphasis on "the eternal verities."

Skill in curriculum building consists in the ability to take account of the findings of many types of research which is competently performed, and to synthesize these findings in the development of a curriculum, which permits the individual child to realize the greatest benefits from his school experiences—benefits which will ultimately result in social advance.

CHAPTER II

Technics of Research Used in the Field of Teacher Personnel

RESEARCH in the field of teacher personnel consists of studies of the efficiency and the status of teachers. The areas generally included are: rating; recruitment for training; preparation; selection and placement; load; salaries; health; legal status; tenure; pensions; supply and demand; subject combinations; and teachers' organizations. Survey studies based on official records or questionnaire returns predominate. Simple correlations are used frequently; multiple correlations and regression equations occur in a few instances. Many investigations are attempts to measure teaching efficiency, or to find correlations between teaching effectiveness and various factors in the abilities or backgrounds of teachers.

Investigations made in the field of teacher personnel are, directly or indirectly, studies of teaching effectiveness; or of some factors or conditions which are, presumably, related to teacher effectiveness. For discussion, studies in teaching effectiveness may be grouped as follows:

1. Measurement of pupil progress.
2. Evaluation of teaching procedures.
3. Analysis of teachers' traits.
4. Other factors in teacher-status presumably influencing teaching effectiveness.
5. Correlations between various factors.
6. Values and needs in research in teacher personnel.

Measurement of Pupil Progress

Teaching is effective or not in terms of resulting, worthwhile pupil improvement. Adequately discriminating measures of such improvement are much needed but are as yet not available. The difficulties of measuring the product are those involved in measuring objectively some of the outcomes of instruction such as attitudes toward the subject and appreciations, and determining the amount of allowance to make for learning due to previous teaching or to instruction by parents or from other sources during the period of time when progress was noted.

Crabbs (57) made use of Franzen's accomplishment ratio formula in an attempt to determine teaching success directly in terms of results achieved relative to abilities of pupils. She obtained measures of initial and final mental age, and achievement ratios for reading, arithmetic, spelling, composition, and penmanship. From these she computed the measure of teacher efficiency in terms of the changes in A. R. effected in the pupils. While this technic appears promising, it involved such large probable errors as to make the results highly unreliable.

In addition to difficulties previously mentioned, other questions of adequate measurement arise. Is there agreement as to what should be the objectives of the unit to be measured and as to the amount of emphasis

which each phase of the various outcomes should receive? Do the tests really measure that which they attempt to measure? If all the objectives can be agreed upon as to emphasis, there is still the question of the total rating of the teachers in terms of combinations of objectives within the subject or within the area of instruction covered by a specific teacher. How can proper allowance be made for differences in pupils' abilities to learn?

To date difficulties have prevented much progress in the objective measurement of teaching effectiveness through direct evaluation of the product. Hence, evaluations of teaching success are being sought through observation of teaching procedures and of teacher characteristics in terms of their estimated influence upon pupil development.

Evaluation of Teaching Procedures

Examples of statistical evaluations of teacher rating scales are: correlations of two applications of the same scale by the same raters to the same group of teachers; of the same individual using different scales; of different individuals using the same scale; intercorrelations between specific items on the scale; correlations between specific parts of the scale and general teaching ability; and correlations between administrative ratings of teachers and ratings by pupils. The measurement of the processes is an attempt to find a "short-cut" measure of the progress of pupils in terms of the processes of the teacher. As such it has all the weaknesses of direct measurement of the product with the additional insufficiencies inherent in the question of whether or not the rating scales are sufficient means of measuring teaching activity.

Analyses of Teachers' Traits

Consideration of the teacher himself is another indirect approach to the measurement of teaching effectiveness. Opinions as to qualities most to be desired in teachers are collected from teachers, superintendents, supervisors, school board members, educational experts, and from pupils in the elementary schools, high schools, and colleges. These traits and activities are often evaluated by members of the various groups mentioned above as to items of most frequent performance and of greatest importance in the personality of the teacher. The results of such accumulations and evaluations seem perhaps of more help in the improvement of teaching through self-analysis than in the measurement of the effectiveness of specific teachers. One difficulty in using such findings or in setting up the traits of the ideal teacher as something to be attained by individual teachers is that specific traits and characteristics may be helpful or detrimental to a teacher according to the combinations in which they occur in him. A further difficulty lies in the impossibility of assigning relative values to the different traits. A characteristic which seems relatively unimportant when all teachers have it in some degree may be of paramount importance in determining the failure of a teacher who lacks it altogether.

Other Factors in Teacher-status Presumably Influencing Teaching Effectiveness

Present conditions—Probably three-fourths of the studies in the field of teacher personnel consist of collection, analysis, comparison, and interpretation of data regarding the general status of teachers. Examples include analyses of salaries of teachers; tabulations of information regarding the average training of high-school teachers in specific states; comparisons of salary with experience, training, type of position, geographical location, or size of school district; surveys and interpretations of legal provisions affecting the status of the teachers; collections of reasons why teachers leave the profession; tabulations of data regarding pension systems, turn-over of teachers, methods used for teachers' improvement, practices in the selection of teachers, qualities most often stressed in letters of recommendation, combinations of subjects taught, contents of codes of ethics, information regarding teachers' associations, and lists of subjects most frequently required in the training of teachers. Comparisons occur between the training of teachers and their specific teaching duties. As would be expected, many correlations are found between salary and experience, training, age, size of community in which teaching is done, type of position, and sex; between age and days of illness, and between experience and teaching load.

Answers to the question, what should be the status of the teacher? are sought from opinions of teachers, laymen, school administrators and educational experts. Other approaches to the same problem are comparisons of the status of teachers with that of other workers of similar training in matters of working conditions, income, length of service, and pension opportunities. Salary recommendations are often based on surveys of teachers' salaries in similar communities and upon comparisons of teachers' salaries with the cost of living, and with changes in living costs. Recommendations as to what should be the status of the teacher and the conditions under which he lives are, of course, based for the most part upon opinions as to the effect of such living conditions upon his effectiveness as a teacher. Investigators frequently compare the actual status of teachers in a specific category to the desirable status as indicated by the opinions collected.

Trends and predictions in teaching conditions—Studies of conditions surrounding teachers in many instances lead to consideration of trends and from that to predictions for the future. Trends in salaries, trends in centralization of control of teachers, in the number of teachers needed, and in teaching load are some of the many areas in which such studies have been made. Index numbers are used in some instances. Occasionally, projections of trends are the bases for attempts at prediction. Estimates of the number of teachers needed from five to ten years after the date of the study have been made for city or state units. One difficulty of such projection is the necessary assumption that conditions will remain somewhat as they are at the time the study is made, or the anticipation of changes in conditions.

There are a number of variables such as shifts in population, changes in birth rate, changes in curriculum demands, changes in pupil-teacher ratio, changes in units of political control, or changes in general industrial conditions which may make any prediction go considerably awry. On the other hand, in the field of training of teachers it is desirable that some idea as to likely relationships between supply and demand be predicted from four to eight years in advance.

Correlations Between Various Factors

Evaluations of measures of teaching through correlations of teacher ratings with pupil achievement, of teacher traits with pupil achievement, and teacher ratings with teacher traits, have shown little agreement between these measures, especially between achievement of pupils and ratings of teachers or traits of teachers. Comparisons have been made between the ratings of teachers and results obtained in achievement in specific subjects such as arithmetic and reading. Boardman (56) ran correlations between ratings which pupils gave their teachers and the answers to such questions as "teacher I like best," "teacher for whom I worked the hardest," "teacher the best disciplinarian," and "teacher from whom I learned the most." French (58) obtained ratings of teaching ability and also scores on thirteen measurable classroom activities. Another approach was the combination of all the ratings of all the teachers in the building and comparison of these ratings with the results of achievement tests within that building.

For the most part, low correlations have been obtained in attempts to relate teaching efficiency to other factors in the status of teachers. Although pupil achievement has been correlated with size of class and with total teaching load, most of the correlations found are between ratings of teacher effectiveness and factors of present conditions, ability on various tests, preparation or background of the teacher, and judgments made when the teacher was selected. Thus we find ratings related to age, years of experience, salary, matrimonial status (women), and credits earned since employed as a teacher. Scores obtained on tests of aptitude, intelligence, interest, character and personality, have been compared with reported teaching success. Quite often the tests are given to students entering or studying in teacher-training institutions and the results compared with ratings of teaching success several years later. In efforts to improve selection and training of teachers, numerous correlations have been run between reported teaching effectiveness and training. Factors used are subjects taken in high school, normal school, or college and grades received in each, grades in practice teaching, preparation in specific subject taught, and extracurriculum activities in college. Kriner (59) related ratings of high-school and elementary-school teachers to pre-college background in an effort to find bases for selecting students in teacher-training institutions. He considered the number of years of high-school Latin, French, mathematics, social science and science; grades; rank in class; whether or not the teacher decided upon

teaching while a student in high school or elementary school; whether teaching was considered when chosen as a stepping stone; and whether the father's occupation could be classed as business man, farmer, or laborer.

A group of studies report relationships between predictions of teaching efficiency made at the time the teacher was selected, and subsequent ratings. Such evaluations were based on the following, singly or in combination: letters of application, evaluations of physique, pictures, personal interview, college credentials, letters of recommendation.

Values and Needs in Research in Teacher Personnel

Our practices and recommendations that affect teachers are based on assumptions that such practices or recommendations lead to improved learning opportunities for pupils. Yet we have little evidence that such conditions do increase desirable pupil development. The selection and training of prospective teachers should depend upon defensible means of locating potential teaching ability and of building upon this ability through training. Research which will produce these means is badly needed, especially in these days of excessive oversupply of teachers and reduced budgets of teacher-training institutions.

Almost every phase of the status of the teacher has been studied to some extent. The needs in this area are primarily more detailed analysis, more attempts at comparison between various phases, and more adequate records which will permit studies covering larger proportions of the teachers in the United States. This is especially necessary in the area of investigation covering the output of teacher-training institutions and the demand for new teachers in the various states.

Analytical pictures of the status of the teacher are valuable bases for improvement. Often the true conditions are not understood until sharply portrayed and clearly interpreted in terms of their influence upon pupil development. Facts are necessary prerequisites to wise changes in requirements. Thus information regarding the relationships between the supply and the demand in qualified teachers must be available to show whether or not a rise in certification or training requirements will reduce the number of qualified teachers below the actual needs of the state or whether or not additional teachers in specific areas need to be trained. Likewise, makers of state salary schedules need to know what differences in cost of living exist between large and small communities. Students considering teaching as a profession should get much guidance from information regarding the status, duties, and opportunities of the teacher, in comparison with the conditions found in other occupations.

Inadequate records are the chief difficulties in the studies of the status of the teacher. Teacher-training institutions, for the most part, keep very meager information regarding the histories of their graduates, even for the first year after the diplomas are granted. State department records are often incomplete and investigators in local school systems find distinct

and sometimes insurmountable handicaps in the lack of adequate records of the teaching personnel. More thorough keeping of records will materially aid research in this area.

The needs for research in the field of teacher personnel go back to search for and agreement upon the expected outcomes of teaching, in terms of the desired development of the whole child. When the outcomes are agreed upon for a specific unit of teaching, research must find means of measuring the extent to which these ends have been attained during the time covered and to what extent the teacher can be credited with this development. The next step is to determine what influence each of the many factors in the status of the teacher has upon the development of the pupil and how much this influence is strengthened or weakened by changes in each factor of the status. Individual variations in these influences will have to be discovered. The extent to which natural ability and training each influence the teacher's effectiveness must be determined, along with measures of the specific contribution which each unit of training in the teacher makes to the development of pupils taught. Minor problems surround each of the major ones mentioned above. Much of the research in this field has shown definite weaknesses in our present assumptions and practices. It is hoped that the next few years will find positive progress.

CHAPTER III

Methods of Research in School Organization

RESEARCH in educational administration is a development of comparatively recent years. The methods of solving administrative problems prior to the introduction of research technics were snap judgments, intuitions, and established precedents. In the division of administration designated as "school organization" the use of research in the solution of problems has been neglected to a greater extent than in other phases of administration, such as finance, curriculum construction, methods of instruction, and business management. The method largely relied on for solving problems in "school organization" was adherence to precedents. As a result the organization of a school system was often inconsistent with school needs. In fact the existing school organization was often regarded by progressive schoolmen as a serious barrier to educational progress and the cause of waste and inefficiency in educational administration.

One of the problems in school organization first to challenge research was the unit of organization for the control and support of public schools. The struggle between the adherents of local district autonomy and centralized control was carried on vigorously in Massachusetts until 1832. In virtually all states that patterned their school organization after Massachusetts, the local community or district was made the unit of school organization and administration. However, changes in the population necessitated adjustments in the unit of organization and administration. Laws were required which would permit the districts to be responsive to rapid increases in school population. The question of the best unit of organization developed into a live issue during the last third of the nineteenth century when the support of the rapidly growing public-school systems became acute.

Leaders in school administration who were confronted with problems of organization might experiment with new types of organization if they could secure public support. Such experiments sometimes involved subsequent validating acts by state legislatures¹ and contests in the courts.² As a rule the leaders resorted to historical appraisal to find precedents for the solution of their problem.

¹ Example: Princeton, Illinois, organized a township high school in 1866 and levied a tax to support the same. The project was strongly supported by public opinion, but the attorney general of the state ruled that the organization was illegal. A validating bill legalizing the organization and the acts of its officers was introduced in the state legislature and passed by that body the following year, 1867 (*Session Laws of 1867*, Volume III, p. 16-18). The school codes of the several states reveal hundreds of acts between 1875 and 1900 validating new departures in school and city organization and administration.

² Example: The school trustees of the village of Kalamazoo, Michigan, were enjoined in the lower court in 1872 from using that portion of the money levied for the establishment of a high school and the salary of the superintendent. The case was carried to the supreme court of the state. Judge Thomas M. Cooley sitting as the court, decided against the injunction in an important ruling which construed the phrase "common school education" as properly including the establishment and support of high schools (30 Mich. 69).

Beginnings of Research in School Organization

The methods of research first applied to the study of problems in school organization were historical and statistical. The earliest investigations were largely the products of graduate students in universities. The best examples of such investigations are the dissertations submitted for the degree of Doctor of Philosophy in education and in departments related to education. The specific phases of school organization first to receive attention were problems bearing on (1) the unit of school control and support; (2) the internal reorganization of school divisions; and (3) the structural reorganization of the school system.

The historical study of the problems in school organization led to a critical appraisal of existing practices in terms of their genetic development. Some of the problems to receive historical treatment were the legal status of the public schools (68), centralizing tendencies in administrative organization and administration (62, 75, 77), the organization of city school systems (81), the development of secondary schools (63), legislation and judicial decisions pertaining to public education (69), the city school district (61), reorganization of the public-school system (64), and the like. The value of such investigations consisted not merely in the new information made available for administrative officers regarding public-school organization, but more especially in the critical attitude developed toward current practices in organization.

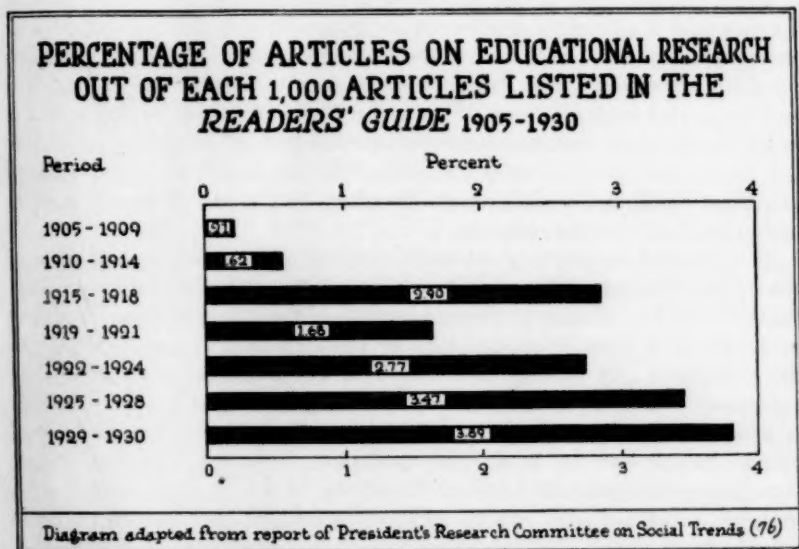
The use of statistical data as a basis for generalizations regarding school organization greatly disturbed many school administrators at first. This statement is supported by the critical attitude of the schoolmen toward the statistical findings of Thorndike (79) regarding pupil elimination from which he concluded that at least 25 out of 100 children of the white population of the United States remained in school only long enough to learn to read simple English, write such words as they commonly use, and perform the four operations for integers without serious error, and that only about a fifth of the children entering city schools continued to the fifth grade. The controversy created by the publication of statistical data which made possible the startling generalization regarding retardation and elimination stimulated administrative officers to study conditions in their own schools. The criticism of public school organization implied by the findings of Thorndike led to a demand for further study of conditions in the schools. The Russell Sage Foundation provided a grant for such an investigation in the city of New York in the fall of 1907 under the direction of Leonard P. Ayres. The results of the investigation in so far as it related to New York were published in the annual report of Superintendent Maxwell in 1908. A more complete report which included comparative data was published the following year (60).

The effect of the statistical studies of Thorndike and Ayres was far-reaching. Administrative officers began to employ statistical methods in the

study of the internal conditions of their schools. The factual findings enabled them to undertake with confidence internal reorganizations of their schools and also encouraged to some extent the structural reorganization of school units, a problem which was becoming acute in many school districts on account of the rapid increase in pupil enrolments.

By 1915 public opinion among schoolmen in support of statistical as well as historical research in educational administration was fairly well established. This conclusion is supported (1) by the proportional increase of articles on educational research appearing in periodical publications, (2) by the establishment of bureaus of educational research in city school systems, and (3) by the activities of administrative officers with respect to the reorganization of the school divisions.

FIGURE 1



Data are presented in Figure 1 which indicate the beginnings of a keen interest in educational research as revealed by the marked increase in the proportion of articles classified as educational research among the titles listed in the *Readers' Guide to Periodical Literature*. The increased attention given to such contributions in periodical literature was concurrent with the establishment of bureaus of educational research in city school systems. Baltimore is credited with establishing such a bureau in 1912; New York, Rochester, and New Orleans, in 1913; Boston, Detroit, Louisville, Kansas City, Oakland, Schenectady, and Leavenworth, Kansas, in 1914; San Diego and Whittier, California, in 1915; Cleveland, in 1916; and Chicago, Los Angeles, Denver, Atlanta, Omaha, and Youngstown, in 1917.

During the same period superintendents were active in reorganizing the divisions of their school systems. Data reported by Bunker (64) to the United States Bureau of Education for 1911 indicate that twenty-four city school systems with populations in excess of 8,000 were making significant departures in their plan of school organization. Three years later (1914) 227 cities were reported either as actually having made significant reorganizations of their schools systems or as considering the making of such reorganizations (80). Thus it is seen that the development of educational research was closely attended with the establishment of research bureaus in some of the larger school systems and the beginnings of significant reorganizations in the divisions of the public school system.

Applications of Research Methods in School Organization

The rapid growth of urban communities in the first quarter of the present century and a still more rapid increase in school enrolment, especially at the secondary-school and college levels, created many problems in administration which often required drastic changes in existing units of control and support, reorganizations of the school structure, modifications of the internal school organization, and the development of organization layouts for the improvement of administration. The important changes required could not be effected by impromptu decisions on the part of boards of education or their executive officers.

The importance of historical understanding and current factual data in the proper solution of the problems in school organization had been demonstrated by the pioneer studies referred to in the preceding section. However, new and broader applications of research methods, particularly in the technics of fact finding, were required. The school systems which had established bureaus of research were usually cognizant of the need for facts in organization and administration as well as supervision. The school systems which had not made such provisions were compelled to imitate the changes in organization of other systems, to act on unsupported opinions, or to seek aid from experts in school administration outside the local school system.

School Surveys

The school survey is a definite response to the need for scientific research in school administration. In a sense a survey is a case study of a school system by an expert. The survey may involve the study of the entire system or some part or problem, such as the school plant, financial program, efficiency of instruction, or need of structural reorganization. The purpose of the survey is to ascertain and interpret facts, and to submit recommendations for development on the basis of the facts. The better surveys usually trace the development of the school system under consideration and appraise the structural organization, the divisions of the system, and the

plan of administrative organization in use. Weaknesses and deficiencies are pointed out and corrective or remedial measures are proposed.

The methods employed in survey investigations have been so fully treated by Sears (78) that further description is not required here. The development of the survey movement paralleled the rapid establishment of bureaus of research in city school systems and reached its peak of development in the decade 1915 to 1925. Some of the school surveys of the period are models of administrative research and have contributed greatly to the understanding of general as well as local problems in school administration. Other surveys present little more than the opinions of the survey directors supported only with observations.

The criticisms of school surveys have usually been directed against the methods employed. This is especially true of the surveys that have dealt with the problems of school organization. Inadequate consideration has been given to the discovery and consideration of trends in practice, and experiments in reorganization have seldom been outlined and advised. Too frequently the surveys have presented masses of inadequately interpreted facts and recommendations based on opinions rather than factual findings.

The development of the survey technic has contributed much to the solution of problems in school organization. Through self-survey or survey by experts from without the system local schools have been able to undertake needed reorganization in the light of facts. Inter-school comparisons have been made possible through the publication of surveys and annual school reports, and data have been made available which render possible the determination of current practices and recent trends.

Questionnaire and Check-list Inquiries

The questionnaire and check-list inquiry as instruments of research have been widely employed in school administration. The ratio of questionnaire to all other types of investigations in administration was found by Koos (73) to be approximately 5 to 3 in 1928. The method is used in collecting information rather than in carrying on fundamental research. The collection of frequency data from representative schools by the method under consideration has made possible the comparative study of current practices in school organization.

The method was employed extensively in the recent National Survey of Secondary Education (74) as a means of ascertaining the status of current practices in secondary-school organization and administration. The data secured reveal dominance or lack of dominance with respect to the practices concerning which information was sought. The degree of dominance thus becomes an important criterion in the evaluation of current practices in school organization. For example, it has been generally believed that the organization of the school year in two semesters making possible the promotion of pupils twice a year was a practice destined to become universal in city school systems. Recent questionnaire data show that this belief is

without adequate support. An inquiry by Chism (65) to a sample group of 490 cities ranging in population from 2500 to 100,000 disclosed that only 40.4 percent of the number have semi-annual promotions. Refinement of the data showed that 62.2 percent of the cities with population between 25,000 and 100,000 and 44.2 percent in the group 10,000 to 24,999 promote pupils semi-annually, while only 26.0 percent in the group 5000 to 9999 and 28.2 percent in the group 2500 to 4999 follow the practice.

In the absence of supporting data for a practice in a given school, probably the best guide for an administrative officer to follow is the dominance of practice in comparable schools. However, dominance should be supported by other criteria of local significance, such as the difficulty or ease of administration of the practice; cost of administration in time, energy, and money; character and amount of technical and general training required of officials responsible for the administration of the practice; and the local need for the practice in question. Without such supporting criteria mere dominance of practice might be wrongly evaluated. High frequency on the one hand might signify either a consensus of good judgment based on scientific data or a general drift toward a low level of efficiency occasioned by conditions difficult to regulate or control. Low frequency on the other hand might indicate that the practice is in the stage of an innovation and has not had sufficient time to become established or that it is rapidly approaching obsolescence.

Questionnaire and check-list inquiries, including the reports made to state departments of education and the United States Office of Education, have constituted the chief source of information regarding current practices in public-school organization and administration. Such information when properly analyzed and interpreted in the light of local needs and conditions becomes the basis of progress in school administration.

The Use of Trends

If questionnaire or check-list inquiries are repeated from time to time trends of development may be ascertained which will prove valuable in the improvement of school organization. Similarly, the study of city, state, and national reports, kept as cumulative records over a period of years, make possible the determination of trends which throw light on changes frequently unobserved by administrative officers because of perspective obtained only from current vantage points. The recent report of the President's Research Committee on Social Trends (76), the monograph by Judd on *Problems of Education in the United States* (71), the repeated inquiry by the staff of the National Survey of Secondary Education (72), and the questionnaire investigation of Counts (66) on the selective character of the secondary-school population, illustrate the need for the annual collection of cumulative data from which present trends can be determined.

The use of trends in the reorganization of the units of school support and control, in the modification of the structural organization of state

school systems, in the improvement of the internal organization of school divisions in local systems, and in the establishment of forms of organization for school administration appears to merit greater attention from administrative officers than this method of investigation has received in the past. The studies already cited will illustrate the technic to be employed in the discovery of trends and in the interpretation of their significance. If fuller discussion of the technic is desired the reader is referred to the statement of principles and procedures for use in this type of research by Crawford (67:58-60).

Experimentation

The controlled experiment has been employed as a method of research in such phases of administration as: methods of teaching; size of class; load; type of instructional material; types of equipment; methods of heating, ventilating, and cleaning; and the like. In school organization the method of scientific experimentation has received only minor consideration. The method of crude experimentation, however, has been widely used in school organization, especially by administrators who act hastily on hunches and guesses.

It cannot be said that the latter kind of experimentation has been without value to school organization. Some of the important contributions to school organization are clearly the results of "cut and try" methods. Historical research reveals both the successes and the failures of such experimentation. At the present stage of development in school administration "trial and error" experimentation with school organization is entirely too hazardous to be encouraged in public schools. The types of research already considered render unnecessary the resort to chance methods.

Planned experiments may be undertaken by local school systems in the readjustment of school divisions, such as the establishment of a junior high school, a six-year high school, a junior college. Similarly, in the internal reorganization of a local school, a departmental organization, platoon plan, modified platoon plan, or all-year school, may be authorized by board authority as an experiment in school adjustment to local needs. The outcome of an experiment rather than snap judgment thus becomes the basis of school reorganization.

The method is essential in school systems which engage in long-time planning. It makes for economy and the elimination of serious mistakes. School authorities desiring to establish sound policies with respect to local school organization will, therefore, in the future make greater use of experimentation in solving administrative problems than has been done in the past.

Conclusion

Research has played an important rôle in the improvement of school organization in both state and city systems in the few years in which it has

been utilized as a method of solving problems in school administration. The refinement of the methods of educational research and the wider utilization of these methods in the scientific study of the different phases of school organization should make for still greater and more rapid improvements in the near future. Numerous problems in school organization can be solved only through research methods. These problems should serve as a powerful challenge to administrative officers and students of educational administration to utilize the momentum already developed and to apply the methods of investigation shown to be applicable in carrying on the needed research in school organization.

CHAPTER IV

Special Methods in the Elementary School—

Problems and Methods of Research

THE first cycle of scientific stock-taking conducted by the American Educational Research Association through the medium of the *Review of Educational Research* has come to an end. It seems highly appropriate that this cycle should terminate with a consideration of problems and methods of research. Previous issues have indicated the results of educational investigations. A glance at prevailing methods of research may now throw a ray of light on some of the causes of failure or success. Certainly the quality of research may be enhanced by greater discrimination in the use of available methods, by improvement of these methods, and by the invention of superior methods. It is indeed regrettable that such an important feature of the cycle must be prepared under the stress of an emergency, for the future of the science of education depends vastly more on quality than on quantity of production.

It will be the aim of the chapter to discuss the general nature of research methods employed in the field of the elementary-school subjects and to indicate types of problems that appear to be of outstanding importance. With common instead of divergent interests of the various subject specialists in mind, an attempt will be made to confine the discussion to problems and technics that are significant in most or all of the subjects of instruction in the field. In other words, an undertaking in special methods will assume the characteristics of an undertaking in general methods. The contradictoriness of this statement is more apparent than real, for the results of special-method investigations promise to become a major source of contributions to a real science of the general methodology of instruction. As matters stand today, the subject of general methods languishes in uncertainty and is threatened with extinction. Having scant sustenance of its own, it has derived its principal support from a set of general psychological principles that were never more insecure than they are today, and now it is on the point of becoming a mere appendage to this psychology. As material accumulates on special methods, analysis should reveal the elements common to the results in various subjects and lay a firmer foundation for general instructional procedure.

Fundamental Problems

It requires only a casual survey of investigations in the school subjects to reach the conclusion that certain fundamental problems are common to all of them. It is easier, however, to formulate this conclusion than it is to specify the problems. At the risk, indeed in the hope, of criticism, the following list is proposed. To each general problem one or more significant subordinate problems is adjoined.

1. Selection of the Activities of the Curriculum.—Is social utility a valid basis for selecting the content of courses?
2. Gradation of the Activities.—What principle or principles should be used in grading the material of the curriculum?
3. Organization of Units.—How should curriculum content be organized for instructional purposes?
4. Direction of Learning
 - (a) To what extent should individual as opposed to group instruction be employed?
 - (b) Should instruction be incidental or systematic?
 - (c) What results are obtainable when pupils, courses, and methods—all three, are properly differentiated?
 - (d) To what extent should specificity as against generality of learning determine the method of instruction?
 - (e) Should instruction proceed through subjects or projects?
 - (f) Is the workbook superior to the textbook system of instruction?
 - (g) Should instruction be based on the principle of acceleration or on the principle of enrichment?
5. Diagnosis and Treatment of Disability.—What will be the contribution of diagnostic and remedial methods to elementary-school instruction?
6. Measurement of the Results of Instruction.—How can improvement in the reliability and validity of standard tests be most expeditiously brought about?

Social utility—By objective investigation it has been possible to solve, for the present and to the satisfaction of most persons concerned, many problems of special method. Does it pay to have pupils use the method of transcription in their study of spelling? Does it pay to give special attention to reading difficulties while attempting to train pupils in problem-solving? Does it pay to emphasize quality first and speed afterwards while developing skill in spelling, computation, and handwriting? For these and scores of other questions educational science, happily, has provided quite definite answers. But in many other sections of the field, one gropes in dense and disappointing darkness.

A few years ago, after digesting the earlier books (85, 88) on the new science of curriculum construction, many came away impressed with the belief that a cross section of social life should provide the content of the course of study in the public schools. Recently the adequacy of social utility as a basis for the selection of material for the curriculum has been as vigorously impugned (87) as it has been defended (101). It now seems obvious that the leading contribution of the principle has been on the negative side. Its application has brought about the elimination of much useless material. The content of courses has been held up beside the results of social analysis, and that which was found in the former but not in the latter was consigned to the educational discard. Some critics urge, however, that one cannot construct a proper curriculum by the method of elimination alone, for that from which the eliminations are made may never have embodied all the elements to be desired. They even insist that the theory is weak on the positive side. What guarantee is there, they ask, that the analysis of social activities will yield all the elements that are desirable? Who would presume to make a

course in character training by taking a cross section of the reactions of adults in situations calling for moral behavior? Who would make a course in music from a similar cross section of the musical performances of average adults? Finally, the critics suggest that the workings of the principle are compromised by the factor of social change.

Limitations of space do not permit a discussion of these questions. They are mentioned merely to precipitate the point that a principle upon which we have been advised to build, and upon which we have been building, has developed some disconcerting weaknesses. The extreme conservative, who believes that the purpose of society and the schools is only to perpetuate the *status quo*, will find in the principle of social utility a perfect instrument. The extreme progressive, who believes that the energies of the school should be devoted almost entirely to improvement of the social order, will find the principle sadly inadequate. What, therefore, should the scientific custodians of elementary-school instruction believe? What is the true range of usefulness of the principle of social utility? Precisely in what way would the critics supplement it, make amends for its alleged deficiencies? These are some of the questions that must be answered before the proper content of courses in the elementary-school subjects will be known.

How does one settle such a question of principle as that between the liberal and the conservative? The argument is frequently advanced that questions of purpose, of aim, of what is desirable, do not belong in the domain of science; that they are problems of value, and science is confined to causal description. The trend of the times, however, is more and more to take such problems out of the field of speculation and bring them into the field of experiment. All science once found its only habitation in philosophy. Concrete embodiment in school practice should give such rival principles an opportunity to demonstrate their worth, just as the contemporary experiments with rival political philosophies in various parts of the world are expected to do.

Other curriculum problems—With regard to the other major problems peculiarly curricular in nature, one encounters a similar impasse. The great demand is for the validation of guiding principles. Happily, in most instances, it is quite evident that science will be able to provide objective methods of application, if only the principles can be determined. This is precisely the situation so far as gradation of the activities of the curriculum is concerned (86). Two principles seem now to be on the point of survival, after a period of competition. These are the principle of difficulty and that of interest. Both are psychological in character and are defended on the theory that they allocate subjectmatter at the point in the development of the pupil where it can be most economically mastered. Should either be depended upon exclusively? Should the principle vary somewhat with the subject of study? Will additional principles be necessary? Experiment seems here to be our only hope, and will, without much doubt, throw light on the relative merits of competing principles.

As regards the problem of organizing activities for instructional purposes, does anyone need to be informed that the profession is overwhelmed with theory and immersed in experimentation? What of integration, fusion, unification? Should projects be substituted for subjects? Which of the various half-dozen notions in regard to the nature of a unit is the most acceptable? The situation is very confused, and very promising. But speculation will probably not lead the way out of these many quandaries. The philosophic tumult and shouting will continue, however, until experimentation brings objectively to light the products of the rival plans and measures them.

? *Instructional procedures: generalization*—Among the problems more intimately related to instruction, there is time to discuss but one: To what extent should specificity as against generality of learning determine instructional procedure? As Judd (92:116) has expressed it, this is "the issue between the view that the duty of the school is the cultivation of comprehensive general ideas and the view that the sole duty of the school is to train pupils in relatively trivial particular skills." The problem is borne in upon us from two directions. We are compelled to give it consideration because of recent discoveries relating to instruction in various subjects of study, and also because of certain new developments in the psychology of learning.

In the subject of spelling there has been a recent revival of interest in methods of generalization or rationalization. The investigations of Archer (83) on transfer of training and those of Archer (82), Masters (95), Zyve (102), King (93), and Sartorius (98) on the use of spelling rules are illustrative of this trend. In arithmetic the studies of Olander (97), and of Beito and Brueckner (84) demand attention. In reading, the controversy regarding phonics, to mention but one problem, should be considered in this connection. Many specialists in reading are still favorably inclined to phonics, long after most of the spelling specialists have turned away. They are being guided by such studies as those of Mosher (96), Gates (90), Sexton and Herron (99), and others. Since phonics means essentially the laws governing the pronunciation of different letter combinations, the educational problem involved is similar to that in regard to spelling rules: Is the specific study of the laws justified? In general, the main problem with regard to such types of generalization is not whether they facilitate progress in a subject, but whether they facilitate it more than other instructional procedures to which the same amount of time is devoted.

It may be said that, in general, the results on spelling rules have been quite negative; those on transfer of training from the learning of primitive forms to the spelling of their simplest derivatives highly positive, but subject to the dangers of negative transfer. If the most recent results are dependable, the minimal spelling list may be considerably enriched, for the simplest derivatives may be omitted therefrom. If Beito's and Brueckner's results (84) are used as a guide in instruction, it would seem as if time could be economized in the teaching of number combinations, for they have

shown in the case of addition that when pupils are taught only the direct form, the reverse form "is learned concomitantly at least as completely as the direct form." Olander (97) reports practically complete transfer of training not only from one set of addition combinations to another, but also from one set of subtraction combinations to another. As regards phonics in reading, especially in beginning reading, the results of investigations leave one in considerable doubt.

We may now turn for a moment to some of the recent conclusions concerning the nature of learning that seem pertinent to the problem. In the first place one may confidently assert that there is as yet no satisfactory definition of a special ability as contrasted with a general ability. Many of the responses that educators consider special are obviously quite general in their nature. They are special neither in the sense that a localized set of neurones is necessary for their occurrence nor in the sense that a particular stimulus is necessary. The work of Lashley (94) and others on the excision of sections of the brain and on variation of the stimulus in studies of the learning process seems to have confirmed this as a fact. Thorndike (100) himself now denies affiliation with a "narrow and oversimplified connectionism which would assert that mental life was nothing but a series of small isolated elements arranged in one row in time, and that each of them formed connections by itself alone and only with the one coming next after it." Even a reflex like the knee jerk is "not a narrowly limited response" (89:26). Indeed, more and more psychology seems to be approaching the view that "the functional units (in mental life) must be regarded as modes of organization rather than single reactions, methods of relating rather than specific associations" (94).

It is fairly clear that there is more interrelationship among various items of the curriculum than has hitherto been recognized. If so, what of the increasing number of unit skills and types of problems in arithmetic? Is it necessary to teach 100 simple combinations and 225 higher-decade combinations in addition? Is it necessary to teach all of the 170 types of problems revealed by analysis in fractions? If not, how will a smaller list be selected? More rigidly controlled experiments should more definitely point the way. We have probably reached the apogee in the multiplication of specific skills and seem on the point of trusting more to the general operation of intelligence.

General Technics of Research

Without pausing to dwell on problems of measurement and diagnosis, let us pass immediately to a brief examination of methods of investigation. Even though other chapters refer to many of the same methods, thus exposing present comment to the charge of repetitiveness, something may be gained if the technics can be indicated which seem best adapted, or at least most favored, for our purposes.

Questionnaire method—A canvass of recent investigations of instructional methods reveals relatively few cases in which the questionnaire has been employed. Studies like that of Hollingsworth, Lacey, and Shannon (91) who investigated the opinions of teachers regarding the difficulty of the elementary-school subjects, are rare compared with the large number in which other methods were employed. In view of the grave weaknesses of the questionnaire method, it is encouraging to observe that it is seldom used in special-method investigations.

Statistical method—At times the statistical method is classified among methods of research as coordinate with the experimental method. When so treated, the two methods are distinguished mainly on the ground that by the experimental method data are gathered under controlled conditions; by the statistical, without such control. As thus defined the statistical method is much less often employed than formerly. Its popularity has been dimmed by the increasing skepticism regarding the efficacy of "statistical doctoring for the ills of the data." The trend is well illustrated in any good bibliography of investigations of the problem of class size. The earliest studies of this problem were statistical in the above sense; the later ones have decidedly favored the experimental technic. This again is a wholesome augury.

Although the statistical method as just defined has declined in favor, it has on the other hand gained tremendously in favor among the more competent investigators as a technic for the treatment of data gathered under controlled conditions. The reports of many investigations, however, are still found to come far short of their true possibilities because methods of computing certain statistical values indispensable to the proper interpretation of the data were not in the lexicon of the investigator.

Experimental method—The types of experimental method employed in the special-methods field may be classified as follows:

1. Group methods
 - (a) One-group
 - (b) Two-group
2. Individual methods: Case studies
 - (a) Analysis of written and oral discourse
 - (b) Use of personal interview and history
 - (c) Application of laboratory technics
 - (1) Tachistoscopic
 - (2) Photographic
 - (d) Pursuit of a diagnostic and remedial program
 - (1) Determining type of disability
 - (2) Discovering cause of disability
 - (3) Removing cause of disability

This classification will probably be found to have less logical than practical merit. It will be obvious to the reader, if he examines the outline, that one employing an individual method may also used a control group, such as is implied in 1b, although one seldom does. Again, while carrying out a

diagnostic and remedial program, one may use all the methods that precede 2d under "Individual methods," or a selection of several of them. The items of individual method, however, are not meant to be logically distinct. The first three under this heading are fairly so. The last (2d) is ordinarily a complex of a variety of procedures.

Favored methods—Whether on account of the adaptability of available technics or a problem preference, the experimentalists in this field seem to have become increasingly absorbed in problems under two categories: the relative merits of different instructional procedures and the causes of disabilities. Under such a program of research progress must be made by comparison of methods of learning and the diagnostic study of cases that fail to profit by them. It is a program designed to discover a rule of procedure and the exceptions thereto. For the first, the method of equivalent groups, on account of its more rigid control of conditions, is increasingly employed by discriminating investigators; for the second, the technic of scientific diagnosis.

The pressure for practical results has no doubt contributed to the popularity of the two-group studies, but those of the other type seem to offer the greater hope of scientific advance. Medical science moved forward when it discovered that a dose of iodine is better for a case of thyroid deficiency than a dose of bicarbonate of soda, but the real contribution came in a causal investigation that eventuated in the discovery of thyroxine. Diagnostic and remedial investigations in education have been directly inspired by medical research, as the borrowed terminology indicates. Like his medical exemplar, the educational investigator first gathers the facts regarding symptoms—the types of erroneous response made by the organism. Secondly, he searches for the causes of the symptoms. Thirdly, in the light of the causation, he endeavors to discover a remedy.

The aims of diagnostic and remedial investigations may be outlined somewhat as follows:

1. They supplement the results of investigations based on averages by providing a method of treating exceptions.
2. They thus contribute to a chapter on the pathology of instruction, many of the findings in which should be serviceable in classroom as well as clinic.
3. They should also contribute significantly to general methods of instruction.
4. They point in the direction of fundamental scientific discovery.

CHAPTER V

Controlled Experimentation as a Means of Evaluating Methods of Teaching

THE evaluation of methods of teaching calls for research of the experimental type. In a controlled experiment two equivalent groups of pupils—one experimental and the other control—are subjected to educational influences that are the same except for the variation in methodology being studied. The difference between the mean gains in achievement of the two groups is calculated as an index of the relative effectiveness of the two methods of instruction. Considered in the abstract the experimental procedure appears promising as a means of evaluating comparable methods of teaching, but when reports of studies are critically examined, a relatively large number appears to be seriously faulty, and when the findings of comparable studies are noted, inconsistencies are frequently revealed.¹ This condition raises the question of the possibility of controlled experimentation as a means of evaluating methods of teaching. In order to provide a basis for an intelligent consideration of this question it is necessary to consider first the crucial difficulties of experimental research. The success of this type of research is conditioned by the dependability of the calculated difference as a measure of the effect of the change in the experimental factor. If the contribution of other influences is large, and especially if this contribution may be large enough to change the sign of the difference, it cannot be regarded as dependable. Hence, we shall inquire into the several influences that may contribute to the calculated difference and the probable magnitude of their contributions.

Uncontrolled Factors

One such influence is that of uncontrolled non-experimental factors. When we inquire concerning the various non-experimental factors that should receive attention in studies of methods of teaching, it becomes apparent that as yet we have only fragmentary information concerning the identification of the factors that contribute to pupil achievement. The following lists, however, are suggestive:

I. Pupil factors

1. General intelligence in terms of point scores, or of mental age
2. Chronological age
3. Previous achievement in the field of experimentation
4. Study habits

¹ The limitation of space does not permit illustrations. The interested reader may consult the *Review of Educational Research* for October 1931, February 1932, and October 1933. The reviews for mathematics and the biological and physical sciences in the February 1932 number and the review for general methods of teaching in the October 1933 number are especially recommended.

II. Teacher factors

1. Instructional technics
 - a. Learning exercises
 - b. Motivation procedures
 - c. Directive procedures
 - d. Diagnostic and remedial procedures
2. Classroom-management procedures
3. Skill in carrying out instructional technics and classroom management
4. Zeal of the teacher with reference to experimental factor

III. General school factors

1. Instructional materials (textbooks, library, maps, laboratory apparatus, etc.)
2. Time devoted to learning activity
3. Concomitant training
4. Size of class
5. Size of school

IV. Extra-school factors

1. Participation in extracurricular activities
2. The pupil's home life
3. Community interest in and attitude toward the school

Space does not permit a review of the evidence relative to the importance of these factors in experimental studies of methods of teaching and hence only a few general comments will be attempted. Such a review is available elsewhere (105). The pupil factors are controlled when equivalent groups are secured and an investigator who forms his groups by matching pupils on the basis of intelligence test score and previous achievement in the field of the experiment, will usually secure a satisfactory degree of equivalence, provided his measures of these factors are reasonably accurate. Even when the groups are not formed by matching pupils, equivalent central tendencies and variabilities, will usually be evidence of satisfactory control of the pupil factors considered.

Among the teacher factors that of zeal in employing a method is especially difficult to control. Preference for a method because of its novelty or because it is a current fad or has the endorsement of certain leaders, is apt to stimulate a teacher to unusual zeal in applying it. On the other hand if a teacher does not believe in a method or considers it undesirable, its application is likely to be indifferent. Another factor whose control is difficult is the skill with which a method is applied.

The rotation technic has been employed by some experimenters as a means of neutralizing the effect of variations in teacher factors. When two teachers are employed, one for the experimental group and another for the control group, they may be rotated at the middle of the experimental period. This procedure will be successful in securing control of the teacher factors when each teacher is equally zealous and equally skillful in applying both methods of teaching. A teacher may instruct with equal skill and zeal in employing two different technics but it is likely that most teachers, because of the lack of familiarity with or a dislike for one of the procedures will teach with less skill and zeal in one of the groups than in the other. When

this occurs, the rotation technic cannot be counted on to secure control of the teacher non-experimental factors.

Another plan for securing control of these factors is to have the same teacher instruct an experimental group and a control group. The success of this method depends upon the degree to which a teacher carries out the experimental and control instructional procedures with equal skill and zeal. It is difficult to conceive of a teacher being enthusiastic in the application of one method at nine o'clock and at eleven o'clock to be equally enthusiastic in applying a different method. It seems likely that eventually she will prefer one or the other of the two methods and hence will teach one class with more zeal than the other.

Unless the learning time is involved in the experimental factor, the total number of minutes spent in study and in recitation should be the same for the two groups of pupils. It may be difficult to secure this condition and at the same time encourage pupil responsibility and initiative in learning. We cite as a characteristic of a good student acceptance of responsibility and a tendency to continue study until a satisfactory achievement is attained, but such a study habit is likely to interfere in an experiment to determine the relative merits of a forty-five minute class period and a sixty minute class period.

These comments relative to the difficulty of controlling certain of the factors that affect learning will serve to indicate the task an experimenter faces. In general, it may be said that the control of non-experimental factors is seldom completely satisfactory. The effect of failure to secure control cannot be calculated, but an experienced investigator may be able to make an estimate. In a number of experiments it appears that the effect has been large enough to change the sign of the obtained difference.

Errors of Measurement

The dependability of the calculated difference is also affected by errors in the measures of the pupil achievement taken as the dependent variable. Of the four types of errors, the variable errors of measurement and the variable errors of validity are not likely to affect the difference greatly. Their effect upon a mean is inversely proportional to the square root of the number of cases and, therefore, will not be large except in the case of small groups. In addition, a considerable portion of this effect usually cancels out in the subtractions made in calculating the difference in mean gains. Equivalent systematic errors in initial and final scores do not affect the mean gain and the difference is not affected when the systematic error is the same in the gains of the experimental group and of the control group. If the directions for administering the test are followed carefully, the effect of systematic errors of measurement is likely to be relatively small, but this condition should not be assumed. For example, the instruction a group of pupils receives may function as coaching for the test. When this occurs a

systematic error of measurement is introduced which will affect the difference.

Systematic errors of validity are more troublesome. When adequately defined the problem specifies the nature and scope of pupil achievement to be measured. Frequently the specified achievement includes more than skills or memorized information. It is claimed that some methods of teaching engender interests, attitudes, or other general patterns of conduct. If the test used does not measure directly all phases of pupil achievement specified by the definition of the problem, the systematic effect may be a matter of considerable importance. For example, experiments designed to determine the relative effectiveness of the individual-laboratory and lecture-demonstration methods of teaching a science have been criticized by pointing out that the test used did not measure directly some of the outcomes claimed for laboratory work. In other words, it is asserted that the test used favored the lecture-demonstration method. If this criticism is true, the calculated difference is probably seriously affected by a systematic error of validity. The use of an objective test frequently means that the measurement of pupil achievement is at least partially indirect and hence the possibility of a systematic error of validity is created. Brownell (103) has discussed at greater length the measurement of pupil achievement in experimental investigations.

Generalization and Application of Findings

The findings of controlled experiments have little value unless their application can be extended beyond the population from which they have been derived. The pupils involved in an experiment have been taught and information concerning the relative effectiveness of the two methods compared is a matter of historical interest only, unless it can be used as a basis in planning the instruction of other groups. In other words, experimental research implies generalization, and hence it is necessary to consider the representativeness of the groups of pupils involved with respect to the population or universe for which generalization is desired. If the experimental population is not representative this condition may contribute to the obtained difference and hence affect its dependability when considered with reference to the larger population or universe.

In considering the dependability of the obtained difference with reference to a larger population or universe it is a common practice to assume that the experimental group and the control group are *independent random samples* and then to restrict consideration of representativeness to the effect of chance in the process of such sampling. The usual method of doing this is to calculate probable error of the difference by means of the following formula:

$$PE_D = \sqrt{PE_{M_1}^2 + PE_{M_2}^2}$$

The result of this calculation is then compared with the obtained difference. If the difference is sufficiently greater than its probable error, it is called statistically significant¹ and this conclusion is commonly interpreted to mean that the sign of the difference indicates the direction of the effect of changing from one method to the other. In other words, if a positive difference has been obtained by subtracting the mean gain of the control group from that of the experimental group, and it is shown to be statistically significant, this fact is interpreted to mean that the method employed in the experimental group is superior as an instructional procedure. If the difference obtained in this way is negative and statistically significant, the interpretation is that the method employed in the experimental group is inferior.

This procedure is subject to two criticisms. In the first place this formula for the probable error of a difference assumes that the experimental group and the control group are independent random samples of the universe for which generalization is desired. These groups cannot be independent if they are equivalent. This condition, however, merely makes the interpretation of the difference conservative, and hence may be regarded as a matter of minor importance.² In setting up an experiment an investigator is seldom free to select the pupils by a random process. Frequently the group is obviously not representative of the population for which generalization is desired. Hence, in general it is hazardous to assume that either the experimental or the control group is a random sample. Hence, the justification of the application of the probable error technic will usually be somewhat doubtful and under no conditions will it reveal the effect of bias in selecting the groups.

The second criticism is that the procedure does not include any consideration of the effects of failure to control completely non-experimental factors or of data faults, except variable errors of measurement, either of which may be sufficiently large to give the obtained difference a sign the opposite of that of the net difference. Hence, it is obvious that even if a probable error technic is appropriate, its application cannot reveal the dependability of the obtained difference.

The preceding discussion of the various causes that may contribute to the obtained difference should emphasize the necessity of inquiring into the effect of all causes before concluding that the net difference has the same

¹ A difference is commonly called statistically significant when it is equal to or greater than four times its probable error. The ratio $\frac{D}{PE_D}$, called the critical ratio, indicates statistical significance when it is equal to or greater than 4.00. The same condition is indicated by McCall's experimental coefficient, $\frac{D}{2.78D}$ when it is equal to or greater than 1.00.

² The formula given above is for the difference of independent (uncorrelated) random samples. When the samples are correlated a product term $(-2r_{SP_{EM_1}, P_{EM_2}})$ must be added under the radical. When an experimental group and a control group have been selected so that they are equivalent they cannot be considered independent. Hence, the short formula is not applicable. A formula for use with matched groups has been derived by Wilks (106). Lindquist (104) likewise has studied the significance of a difference between matched groups.

sign as the obtained difference. Occasionally the obtained difference may be so large that the possibility of the net difference having the opposite sign is so remote that the inquiry may be dispensed with. Such cases, however, are rare. The care that is frequently taken to secure a control group equivalent to the experimental group and the development of formulae for calculating the probable limits of the effects of chance and of the unreliability of test scores suggest that the findings of carefully conducted educational experiments may be expected to be highly dependable when the experimental coefficient is 1.00 or greater. This implication is unfortunate. Frequently the obtained difference, even in a carefully conducted experiment, is not highly dependable. Before the obtained difference can be pronounced dependable it is necessary to give careful attention to the effect of failure to control non-experimental factors and to the possibility of systematic errors, especially those of validity. When generalization is desired it is necessary to consider also the representativeness of the group, which is usually not a random sample.

It should be clear from the preceding discussion that experimental differences are frequently not dependable measures of the relative effectiveness of the methods of teaching being compared. This conclusion suggests the question of the future of experimental research in this field. Are the difficulties such that they cannot be overcome? Or is it likely that experimental techniques can be improved so that dependable findings will be secured in wisely planned studies of methods of teaching?

Future Needs and Problems

It is hazardous to predict the future, but a critical examination of a large number of experimental studies does not induce one to give an optimistic answer. In fact it seems appropriate to ask if there are any best methods of teaching. It appears reasonable that the effectiveness of a method may be conditioned to such an extent by a teacher's confidence in it and the zeal and skill with which she applies it that the method itself is a minor factor in teaching success.¹ Furthermore, mechanized instruction does not represent our ideas of good teaching. We say that the superior teacher is resourceful and constantly adapts her instruction to the needs of her pupils as they are revealed from day to day. A method that is best today may not be best next week. A method that is best for one class may not be best for another. These hypotheses, which are supported by considerable experimental evidence, are not compatible with a list of methods ranked in order of merit. In other words it appears doubtful if the relative merit of comparable methods of teaching is a stable thing and a determination may be applicable only to a particular teacher and a particular teaching situation.

This conclusion raises the question of the value of experimental studies of methods of teaching. If we cannot expect to determine the relative mer-

¹ This statement is not intended to apply to teaching procedures that are not compatible with psychological principles of learning.

its of methods, what is the value of such research? Experimental inquiry during recent years has added to our understanding of the teaching process. A number of experiments have contributed to our understanding of the learning process. Considerable progress has been made toward identifying the factors that affect learning. We have learned something of the conditions under which certain methods are effective. In general, it may be said that experimental studies have contributed to more precise and critical thinking about methods of teaching. Experimental inquiry is likely to be stimulating to the teachers participating in it and hence may be valuable as a supervisory procedure. Hence, a strong argument may be advanced in support of experimental studies of methods of teaching.

It may be observed, however, that since the crucial difficulties of experimental research have been revealed, an investigator should not expect to receive recognition for his work unless he employs the best technics for dealing with these difficulties. The experimental factor should be defined and restricted so that the findings may be interpreted with precision. The nature and scope of the pupil achievement to be measured should be specified. Attention should be given to the control of non-experimental factors, especially those relating to the teacher. Measuring instruments adapted to the requirements of the problem should be selected or constructed. The experiment should be continued for a period of time sufficient to reveal the effect of an extended application of the method. Finally, the experimenter should consider the dependability of the obtained difference with reference to the control of non-experimental factors and the possible presence of systematic errors of validity.

CHAPTER VI

Methods of Research in School Finance

THE financial problem of the schools has, and has always had, two parts: *securing* the money for running the schools, and *spending* the money. Neither part of the problem can be neglected if the schools are to function at the highest degree of efficiency.

In examining and appraising the financing of schools, a first matter to consider is whether the revenues are adequate. While it cannot be said that the amount of money expended is the only determinant of the efficiency of an institution, no one will gainsay that adequacy of revenue is a potent factor. There is an old saying that "money makes the mare go"; likewise, it may be said that money makes the schools go. Schools cannot be financed out of the air, nor on the good wishes of their friends. Teachers must be paid; school buildings must be erected, operated, and repaired; supplies and equipment must be furnished; and many other services, materials, and conveniences must be provided, if the schools are to function properly, or at all. Needless to say, all these services, materials, and conveniences cost money, and the money can be secured only from the pockets of the people.

Securing the money is, however, only one side of the financial problem; indeed, because of the abiding faith of the people in education and because of their usually abundant financial resources, it has usually been the easier side of the problem. After the money has been secured, it must be spent in the most economical way possible, and always with the aim of purchasing the most and the best education possible. Because of the many opportunities for waste—opportunities inherent in the huge size and the technical nature of education—the expenditure side of the financial problem of the schools is by far the most difficult side, and insufficient attention has been devoted to it by school officials and employees.

The Present Urgency of the Financial Problem

Money for public purposes has never been easy to secure from the people; it has never been easy "to pluck the goose without making it squawk." We are not lamenting this fact; we are merely citing it. Indeed, it is opined that the practice of the public of keeping taut its purse strings is a meritorious practice. The public is being constantly bombarded for more and more money for innumerable purposes, and if it furnished all that was requested it wouldn't be long until bankruptcy stalked the country. If private enterprise is to continue to thrive, the public cannot give more than a certain percent of its income for public purposes. The schools must be satisfied with their rightful share of the public's money, and must ever realize that, although the providing of education is undoubtedly the most important function of a democratic government, it is by no means the only function.

The degree of financial support of the schools is largely determined by business conditions. When business moves on an even keel, the financial support of the schools moves likewise; when business is better than average, the financial support of the schools is likewise improved. On the other hand, when the business goose does not hang high—when general economic conditions are disjointed and the nation is in the slough of depression—money flows sluggishly in all channels and even the schools are affected. To the credit of the schools, however, and to the glory of the faith of the people in education, the school is among the last of the institutions to feel the axe of depression and the axe is laid more lightly upon it than upon any other institution.

The nation, as all the world, is now passing through a severe business depression, one of the most devastating in history, the economists tell us. When we shall reach the bottom of the economic ladder, if we have not already arrived, and begin the inevitable climb to better times, no one knows. Judging from past depressions, however, the turn in events should not be far away, if it has not already arrived. In the meantime, the depression is taking its toll from the schools. Radically-curtailed school budgets are the rule everywhere, and in a few communities the schools have been required to close because of lack of revenue. This, in brief, is the unfortunate condition in which the schools now find themselves and defines the vexatious problem with which school officials and employees are confronted.

Numerous and difficult though their problems are, this is not a time for school people to assume a defeatist attitude and to look upon the world through dark-colored glasses. It is their obligation to carry on, and, as always, to maintain the schools at the highest efficiency possible. Optimism and faith are needed rather than pessimism and cynicism. We should not lose sight of the fact that such periods of economic disturbance as that through which the world is now passing have occurred many times before, and that the nation and its schools have surmounted all difficulties and moved on to loftier heights; we are not entering another "Dark Ages" of several centuries of duration, nor has the world gone into a hopeless tail-spin. It is in times of stress, especially, that lessons are learned which fructify abundantly in better times. In times of stress we are forced to appraise more critically our practices and to place first things first. "Sweet are the uses of adversity."

Contributions of Past Research

Remembrance that the financial problem has been ever present with school officials and employees, that the problem has always been especially urgent during business depressions, and that the problem has always been successfully met, should give school officials and employees greater courage in facing the same problem today. In fact, the problem should be faced with greater courage and hope today than ever before because we know

more about the problem and ways of attacking it than ever before; experience and research have provided that knowledge.

Regarding the lessons of experience, little need be said. Suffice it to say that the lamp of experience still remains the best guide to the future. It is apparent, though, that experience may be static or progressive, and that for progress a stimulant is needed. It is the function of research to provide facts which can be used in improving experience and in making it more progressive.

During the last two or three decades research activities in school administration have moved apace and probably in no area have they moved more rapidly than in school finance. They have moved especially rapidly during the last decade, the impetus being given first by the business depression of 1920-21 and second by the business depression of 1929 to date. Times of financial stress—times fecund with economic problems—seem to stimulate research activities in school finance. The last severe business depression in this country began in 1920 and lasted until 1921. The schools then faced a critical financial situation as they face today. The result was the calling forth of the research energies of school people and interested citizens everywhere. The Educational Finance Inquiry (109) was born under those conditions, and during its short life it made a lasting contribution to our understanding of the financing of the schools. It was the first nation-wide survey of school finance. Moreover, that inquiry was no doubt largely responsible for giving research in school finance a tremendous stimulus during the succeeding years.

A similar survey of school finance has recently been under way, namely, the National Survey of School Finance, which went forward from July 1, 1931, to November 1, 1932. Realizing, no doubt, the importance of education, the dependence of it upon proper financing, and the financial stress of the schools, the 71st Congress, in 1931, directed the Secretary of the Interior, through the Office of Education, to make a survey of school finance, for which not more than \$350,000 was to be expended. Congress appropriated \$50,000 to be expended during the first year of the survey, but because of budgetary difficulties failed to continue the appropriation beyond the first year. Because of lack of funds, which caused the untimely demise of this survey, it was possible to salvage only three volumes (108, 110, 111) of the projected series of reports.

Among the most valuable volumes of each of these surveys were the bibliographies. The first (107) included all of the research on school finance up to 1923. The second (108) included all of the research from 1923 to 1931. Comparing the bibliographies, it is interesting to see the rapid development of research in school finance during the last decade; probably greater progress in research in school finance has been made during the last decade than during all previous decades. For example, the first bibliography listed only a few doctoral dissertations—those of Cubberley, Strayer, Elliott, and Swift, whereas the last bibliography listed dozens of

dissertations on practically every phase of school finance; in addition the last bibliography listed hundreds of less intensive studies on scores of problems in school finance. Although these studies have probably not yet given the final answer to any problem, they have provided much valuable information which is now affecting, and will continue to affect, theory and practice. They have improved our knowledge of such problems as those involved in securing revenue, equalization of educational opportunity, indebtedness, and financial accounting.

Type of Research Needed

It has just been stated that the last few years have seen a tremendous development of research in school finance and that this research has been of incalculable benefit in helping to solve the general financial problem of the schools. The problem, however, is not yet solved, and perfection is far from being realized, perhaps never will be realized. In the next succeeding paragraphs we shall venture to point out two large shortcomings of past research in school finance and to indicate the line of progress for the future.

First, research of a more practical nature is needed, research which will contribute to the solution, or at least to a better understanding, of the more urgent problems relating to the financing of the schools. In spite of the fact that it has been of great benefit in providing pertinent information and in helping to point to a valid conclusion, much of the former research in school finance has not realized its potentialities because it was not directed at the solution of the large problems; much of it has been done in a perfunctory and mechanical manner, and charity must be exercised when it is labelled research. Too much of it has consisted of the collection of isolated facts, which, although they may be interesting, possess little practical value because they are not integrated with other facts and are not focused upon the solution of a vital problem. Too much of it has been of a general survey nature only and designed for propaganda—propaganda designed usually to secure more money. For example, the problem of determining the best bases on which state aid should be distributed has been a perplexing problem ever since state aid has been distributed, yet the problem has never been attacked in a sufficiently intensive, exhaustive, and scholarly manner; the same comment could be made for many other problems—problems complex enough and numerous enough to challenge educational Solomons for years to come (110).

Second, better technics of research are needed for ascertaining what is good practice and what is bad practice, and those technics must be more intelligently applied. Furthermore, we must have a better concept of what is meant by good practice and by bad practice. On only a few practices do we know what is good and what is bad; through experience and research we have come to believe that certain practices are better than others, but we do not know *how much* better. Helpful though the knowledge may be, it

does not suffice to know that certain practices are better than certain others—we must try assiduously to ascertain the *best* practice. Furthermore, we have the obligation of ascertaining which practice is best for each situation, and we must ever remember that each situation is partly unlike every other situation. Since different situations present different problems, best practice for every situation cannot be determined by formulae, as certain investigators have complacently assumed.

The best practice can only be determined by ascertaining what is best for the pupil in relation to cost. That is the final test, and it cannot be answered by authority and mere opinion. It can only be answered through experimentation and the interpretation of the results of research by means of a sound and tested philosophy of education. For example, whether fiscal independence is better than fiscal dependence must be determined in the final analysis by benefits to pupil in relation to cost; likewise, whether men teachers are better than women teachers, whether state aid for special projects is better than general aid, whether classes should be larger or smaller, whether consolidated schools are better than one-teacher schools, whether there should be a large or a small amount of state supervision of funds granted to local communities, whether a certain method of teaching is better than other methods, whether 50 or 75 percent or some other percent of the total school budget should go for teachers' salaries, whether classroom supervision really pays, and whether a county clerk would be better than several local clerks for the rural school districts, must be determined by benefits to pupil in relation to cost.

In brief, research in school finance in the future must take greater account of causal relations than it has in the past. It must undertake to ascertain the relation between cause and effect; and by "effect" is meant the effect upon pupil accomplishments. In the past, three methods of trying to ascertain the best practice have been employed. We shall briefly describe and criticize each of these.

Probably the chief method of determining the best practice has been to rate it according to average practice. In using this method the assumption is that "the middle of the road is the safest place in which to walk." It cannot be safely assumed, though, that average practice is the best practice and that it should consequently be patterned after by every school and school system. Local needs should determine the practice for a particular school or school system to follow and not what another school or school system is doing. To know the average practice has the advantage of making us more aware of our own practice and should stimulate us to study our practice to ascertain whether it is as efficient as it should be; but *what* is does not necessarily determine *what ought to be*.

A second method of ascertaining the best practice is by means of statistical correlations. It should be kept in mind, contrary to the belief of some students, that a correlation does not necessarily prove a causal relation. For example, the writer found in a study which he made a few years ago that

there was a very high correlation between the reading proclivities of the people of the various states and the efficiency of the school systems of those states; in fact, the correlation was above .90. In undertaking to interpret this high correlation it was tempting to conclude that an efficient school system made more avid readers, that good schools were the cause and reading avidity was the result; but the facts did not justify that final conclusion, because we did not know the influence of other factors.

The third method of determining best practice has been by means of majority opinion. Regarding this method it is worth remarking that majority opinion, even the opinion of the so-called experts, cannot determine the best practice; unfortunately many research students assume that such opinion is infallible when, as a matter of fact, the opinion of the experts has often been proved fallacious. Such opinion provides interesting, and no doubt worthwhile, information but it cannot take the place of objective and tested information. This more objective and tested information must come from experimentation, from a careful measuring of the relation between cause and effect.

To correct the situation just described, namely, that research students in school finance work largely without purpose and plan and employ inefficient methods of research, two steps should be taken. In the first place, research students must sense the large and urgent problems and secure the training and courage which will qualify them and stimulate them to attack those problems. In addition to knowing methods and technics of research in school finance the student of school finance must have a broad and balanced perspective. Without this perspective he cannot properly interpret his data and formulate a constructive program; without it he would be as futile as Hamlet on the stage without the other actors. The research student must see problems and facts in their relationships with other problems and facts; every area of learning is as broad as civilization. Knowledge of the organization and administration of schools will not suffice for the student of school finance; he must be informed on facts of economics, sociology, and other related fields.

In the second place, an organization and integration of the research energies of various workers should be effected, to the end that all data which are necessary for the solution of the problem selected for attack may be secured. Most of the problems of school finance are too large to be solved by one research student. To secure the largest benefit from research each research worker must be aided by many other research workers; and each must know not only what he is to do, but also how his labors will coordinate with the labor of other students. In order that this coordination may be effected it would seem advisable to have a national clearing house for educational research; possibly the American Educational Research Association could provide such a clearing house.

CHAPTER VII

Technics Used in School Building Surveys

IN the material which follows, there is given a running description with some appraisal of the technics commonly used in school building surveys. This material is arranged under the following eight headings: the growth and character of the community, type of school organization, school population, evaluation of the school plant, utilization of the school plant, school building needs, determination of room requirements, and financial ability of the district to provide for the recommended program. These are discussed in this same order.

Growth and Character of the Community

The necessary and first considerations in the survey of a school system are: the study of the population, the estimates of its changes over the period included by the survey, and an analysis of its present and probable future industrial life. The population of a community may increase by density or by expansion. The increased density of the population in a particular area is conditioned by the number of vacant building lots suitable for residential purposes and the tendency toward the erection of multiple-family or apartment houses. Since one of the chief functions of a school building survey is the location of new sites, it is necessary to consider the probable direction of the expansion, keeping in mind that the aggressiveness of the developmental organizations is a most potent factor in determining direction of growth.

The importance of arriving at the best estimate of the future population of a given school district is, of course, self-evident. Among the methods which may be used in computing population forecasts are the following:

1. Pearl's Formula
2. Mill's Formula
3. Compound Interest Formula
4. The Straight Line Regression Method
5. Anti-logarithmic Method
6. Link Relative Method
7. United States Census Bureau Method
8. Forecasts made by the Bell Telephone Company

Of these methods, the Bell Telephone figures are perhaps the most usable, for they do not depend on a single method, but make use of a number of technics, including actual field analysis of the area in question. Also, since these estimates are to serve as the basis for the extension of telephone facilities, they tend to be uniformly conservative.

It is the writer's judgment that it is better to underestimate population than to overestimate it. By erecting flexible types of buildings, additions can easily be made if needed, but if a school district has its money invested in school buildings not needed, little can be done about it.

In addition to the population as such, there are certain other factors to be given consideration in studying the growth and character of a community. Among these are:

1. The residential building permits, together with their distribution, and number of families for which they afford accommodation.
2. The number and distribution of births and deaths.
3. The size of families by wards of the city.
4. The increase in the number of voters registered by precincts.
5. The distribution of the population as shown by the enumeration districts of the federal census.
6. The changing distribution of population by age groups.
7. Sanborn maps which show the size, type, kind, use, and location of each building in the city.
8. Increase in service connections by public utilities, such as telephones, gas, electric light, and water. In the use of these it should be observed that the number is affected by an increasing proportion of the population availing themselves of these conveniences, as well as an actual increase in population.

Various studies have been made of the validity of these measures with varying results. In general these factors are indicative rather than conclusive.

Some analysis of the composition of the present population is also essential. This is especially true in communities having race segregation in the public schools or in communities having a relatively high percentage of foreign-born peoples. In the latter, it has been found that the proportion of the total school population enrolled in the high schools is considerably less than in communities having a high percentage of native-born residents.

As already noted, it is essential to take into account the industrial and commercial life of the community. One of the important items in this is the type of industry, that is, diversified or single. Communities having diversified types of industry are less affected by periods of depression than are communities dependent largely on a single industry. Account should also be taken of the type of product from the point of view of the present and probable future demand for it.

The direction of the industrial development is conditioned, particularly in heavy types of industries, by the available trackage facilities. It is well known, of course, that the manufacturing section of a community is near the railroads. Since there are few if any children in sections given over to heavy-type industry, it is necessary to take this factor into account. The rapid increase in motor trucking has given the lighter types of industries greater freedom so they may be found in sections some distance from railroads where land is cheaper. Most cities of 50,000 population and above have zoning restrictions which largely determine the character of the growth in various sections of the community. The importance of these to a school building survey is of course obvious.

Among the sources from which information on the population and industrial life of a community can be secured are: the federal Bureau of the

Census, federal Department of Commerce, local department of vital statistics, the city building department, public utility offices, and the Sanborn maps. These maps are made by the Sanborn Map Company of Chicago, and are generally found in communities of 3000 population or more.

Type of School Organization

The importance of a statement of policy with respect to the type of school organization is at once apparent. Whether the schools of a given community shall operate on an eight-four, a six-three-three, or six-six type of organization is a problem for the board of education to determine. This decision on the part of the board of education is well illustrated by the following action of the board of education of the city of Detroit just previous to launching an \$18,000,000 building program in 1919:

1. That the educational needs of children in the kindergarten and the first six grades be met by building large elementary schools with auditoriums and gymnasiums planned definitely to satisfy the requirements of the "platoon" or duplicate form of organization.
2. That the pupils of the seventh, eighth, and ninth grades be provided for in large intermediate schools built to house at least 1200 pupils and equipped to care for the needs of three groups of pupils:
 - (a) Those who are certain to continue their studies in the high school.
 - (b) Those who are certain to leave school as soon as the compulsory law will permit.
 - (c) Those whose future in school is uncertain.
3. That children of grades ten, eleven, and twelve be provided for in cosmopolitan high schools equipped to meet the physical, social, intellectual, and vocational needs of various types of pupils.

The necessity for such a declaration of policy is essential when one considers the effect which different types of organization have on the school building needs. Take, for example, the eight-four organization as compared with the six-three-three type. In the first case the elementary schools must be designed to accommodate the first eight grades, while in the second, only six grades. Moreover, in the first type of organization there are only two divisions in the school system while in the second there are three distinct types of schools. Similar differences are found when one examines the building requirements needed to accommodate either one of these two types as compared with the six-six, or some other form of organization.

In case no formal action is taken by the board of education, the survey staff must assume a certain type and plan the program accordingly. In some cases it may be desirable to develop a separate building program for more than one type of organization, showing for each the requirement and estimated cost. This allows the board of education to make the final decision on the organization to be used.

School Population

Among the steps taken in the analysis of school population, the following are the most common:

1. A study of the school enrolment by grades over a period of ten to twenty years in order to get trends of increase in total enrolment as well as in the different divisions into which the system is divided. The shifting in the proportions found in the different divisions is well illustrated by the figures for the state of Ohio. On June 30, 1903, 93 percent of the total enrolment of the state was in the elementary schools, which at that time included all below the ninth grade, and 7 percent of the total enrolment was in the high schools. On June 14, 1933, or thirty years later, the distribution showed 66.1 percent in the elementary schools and 33.9 percent in junior and senior high schools.

2. A comparison of the total population with the school enrolment by decades for a thirty- or forty-year period to get trends on the relationship between total population and the number enrolled in the public schools. This relationship, which in the main does not show a wide variation, may be utilized in forecasting the school enrolment.

3. A study of non-public schools and their probable future program. This is important since the proportion of the total school enrolment found in non-public schools varies from zero to as much as 50 to 60 percent. Furthermore, many non-public schools have been forced to close during the past three years, thereby sharply increasing the public school enrolment.

4. A comparison of the ratio between enrolment and enumeration over a period of years. The more stringent compulsory school laws recently enacted tend, of course, to increase this ratio.

5. Consideration of the effect which the possibilities of expansion of the area of the school district may have on the school population.

6. Finally, on the basis of the estimated total population, the past growth in school enrolment, and the other factors already outlined, the final estimates of future school population together with distribution among the divisions recommended for the school system are made.

Evaluation of the School Plant

After the estimates on the school population and its distribution have been made, the next logical step in the development of a school building survey is the evaluation of the school buildings included in the system. Experience has taught that the use of a standard score card, semi-objective in character, is most satisfactory in ascertaining the worth of the buildings for instructional purposes. The results obtained from their application are also very effective in the presentation of the survey findings. The score cards most commonly used for different types of school buildings are:

1. For one-teacher school buildings, *Butterworth School Building and Score Card* (113).
2. For graded elementary schools, the *Strayer-Engelhardt Score Card for Elementary School Buildings* (120) and the *Stevenson-Ashbaugh Score Card for Elementary School Buildings* (119).
3. For junior high school buildings, the *Strayer-Engelhardt Score Card for Junior High School Buildings* (122) and the *Arnold-Holy Score Card for Evaluating Junior High School Buildings* (115).
4. For senior high school buildings, the *Strayer-Engelhardt Score Card for High School Buildings* (121).

In applying these score cards, it is desirable to have at least three individuals score each building. The writer believes that the most satisfactory method is to have these individuals score the building together, since each individual then gets the benefit of the observations of the group.

In the presentation of the data on the evaluation of the plant, a number of methods are used. Among these are a comparison of the total scores allotted each building with the standard score by means of bar graphs, the amount of play space per pupil as contrasted with the commonly accepted minimum standard, graphic representation of the scores on the major subdivisions of the score card for each of the buildings, and the arbitrary division of maximum scores into good, fair, poor, and unsatisfactory or some other descriptive terms.

The statement is frequently made that a school building scoring less than 500 on a score card of 1000 points is unsatisfactory for school purposes. Due to the very large number of items making up the total score allotted to a building, it does not follow that two buildings scoring 500 each are of equal value. It is generally true, however, that a building scoring less than 500 is in such condition that it does not warrant the outlay of money needed for major repairs or alterations. In general, buildings scoring less than this amount are not suitable for school use for more than a five- to ten-year period.

Although some attention is given to seating equipment in the standard score cards, it is not commensurate with the importance of this facility. Rather extensive research has been made of public school seating, practically all of which reveals an almost total disregard of this important function.

In connection with the West Virginia State survey (116:124-60), a study was made under the direction of Bennett of the 12,340 seats in the Charleston public schools. The actual checking was done by the physical education staff of the schools who found among other things that seats were too high for from 56 percent to 97 percent of the pupils in different divisions of the school system, desks too high for 87 percent of the elementary pupils, seats too deep in 30 percent of the desks and practically all the chairs, and bad posture observed in 51 percent of the pupils, a large majority of whom were boys. In Grand Rapids, Michigan, where a similar survey was made, the same unsatisfactory conditions were found.

Utilization of School Buildings

In addition to an appraisal of the school buildings, it is essential to make some analysis of the actual use to which they are being put. Morphet (117) made the outstanding study in this field. Two measures were applied in this study, room utilization and pupil-station utilization. The former applies to room usage without regard to capacity, whereas the second relates capacity to the number of pupils making use of a room. For example, under the first, a room of 40 capacity used by ten pupils during a period would be given 100 percent room utilization, but only 25 percent station utilization. Just what constitutes satisfactory room and station use is a matter of judgment. Obviously in small schools, particularly where the room sizes are uniform, as is too often true, little can be done to increase the pupil-station use. Prevailing opinion, as the writer interprets it, is that room use

ought to approximate 85 percent and pupil station use from 50 to 70 percent, depending on the size of the school. A careful analysis of many buildings thought to be overcrowded has revealed very low room and pupil station use. This fact makes apparent at once the importance of this analysis as one of the determining factors in arriving at the actual school building needs.

School Building Needs

Thus far the community, the school organization, the school population, and the school plant and its utilization have been studied. The next step is to determine the school buildings needed to house the estimated enrolment, according to the predicted population and its distribution. In doing this, of course, the maximum use must be made of the present buildings and equipment. This means that their capacity must be determined in order to know how much additional room will be needed. Just when a building is overcrowded, particularly junior and senior high school buildings, where the classes move about, is most difficult to determine, but in general the criterion of this condition should be the point at which additional pupils decrease instructional efficiency. The writer knows a high school built for an enrolment not to exceed 1800, yet for two years cared for 2900 without a noticeable decrease of efficiency, according to the principal and his administrative staff.

In locating new buildings in the ultimate plant, the size and availability of new sites and the distance which pupils should be required to walk are especially important. It is pretty generally agreed that an elementary site should contain from three to five acres, a junior high school site should contain from eight to ten acres, and a senior high school site should contain from ten to twenty acres, depending on the size of the school. In their location, non-contributing areas such as cemeteries, parks, and playgrounds must be taken into account, while in cities having zoning ordinances, cognizance must be taken of the designated use of each section of the city. Just how far children might be expected to walk to school cannot be definitely determined. The state laws on the distance which a pupil must be from school before transportation will be provided by the district are indicative of the judgment of the law makers. Although most of these specify one and one-half miles as a minimum, the distances used in most building surveys are much less. These standards are in general as follows: an elementary school should serve an area of one-half mile radius, a junior high school one mile, and a senior high school from one and one-half to two miles. The size of the school units will be conditioned by these standards, the density of the population, and the proportion of the total population enrolled in the public schools.

The very rapid increase in motor traffic has made it necessary to locate schools so that the minimum number of children shall be required to cross the more congested streets and intersections. A most helpful method of

doing this, particularly in larger communities, is to "spot" the location of traffic injuries and fatalities occurring to children of school age. Such a map serves not only in locating new buildings, but in making district boundary lines as well.

From a consideration of these factors, definite specific recommendations covering both the immediate and future needs of the community for new sites, site additions, new buildings, building additions and alterations together with estimated costs of the entire program are made.

Determination of Room Requirements

Recommendations concerning room requirements generally indicate the number of rooms for elementary schools and the pupil capacity in junior and senior high schools. Since the degree to which a school building serves its intended purpose is so largely contingent on providing the right type and amount of space for each activity, too little emphasis has, in the writer's judgment, been given to this factor. Too often the matter has been left to architects and others not familiar with educational procedure to determine this distribution. The two chief published studies in this field are those by Packer (118) and Anderson (112). In both of these studies formulae have been developed which, when applied to a given program, indicate the number and kinds of rooms required for adequate housing. In addition to these, an unpublished study by W. K. Wilson is being successfully applied by the Division of Schoolhouse Planning of the New York Department of Education, from which source information concerning it can be secured. The importance of this aspect of a school building program needs, in the writer's judgment, much more emphasis than it has thus far received.

Financial Ability of the District and the Recommended Program

The financial ability of the district should now be studied and the estimated cost of the recommended program should be incorporated in the financial program. In this analysis two types of comparisons are generally made, namely, those with a group of communities of similar size and character, and comparison of certain financial items over a period of years in the district being studied.

One of the most effective means of stimulating a satisfactory response to the financial proposals by the electorate is comparisons with other communities. Items which may be included in such comparisons are:

1. Taxable wealth per inhabitant.
2. Taxable wealth per pupil enrolled.
3. Tax rate in mills per dollar for school purposes.
4. Tax rate in mills per dollar for all purposes.
5. Percent which school tax rate is of total tax rate.
6. Indebtedness for schools per \$1000 of wealth.
7. Bonded indebtedness for purposes other than schools, per \$1000 of wealth.
8. Value of school plant per pupil enrolled.

9. Percent which indebtedness for schools is of value of school plant.
10. Current expenditures per pupil enrolled.
11. Expenditures for operating expenses for schools per \$1000 of wealth.

In the second group of comparisons certain financial items within the district are studied over a period of years, the length of which is frequently conditioned by the available data. Among these are the total taxable wealth and the wealth per pupil enrolled, the tax levy for school purposes and for all purposes, the proportion of the total tax rate going for school purposes, the school bonded debt as compared with the municipal debt and the current expenditures per pupil in both elementary and high schools. In addition to these comparisons, a careful analysis of the present bonded debt for each year until entirely liquidated, together with the relation which the present bonded debt bears to the legal bonding capacity of the district, is made. From the data presented in this section and the preceding ones, there should come the most important table of the survey, namely the recommended financial program.

The table should give the principal and interest payments on the present bonded debt by years until liquidated, the annual principal and interest payments on each of the proposed bond issues, the total annual principal and interest payments for both the present and proposed bond issues, the estimated tax duplicate by years, and the millage levy based on the estimated tax duplicates necessary to carry the proposed program.

In addition to the seven basic factors outlined, there is the final problem of selling the program to the community. Since, however, the techniques of the problem involve the whole field of school publicity, it does not seem advisable to attempt a discussion of them here.

In conclusion, some cautions should be pointed out in the use of the survey method of research in the field of school buildings. The projecting of a school building program is, of course, based on the estimated future needs of the community. In the formulation of these estimates, a large body of material is gathered but even with the most complete data available, there is the element of probability. No board of education should, therefore, blindly follow a school building survey extending over a five- to twenty-year period, but before authorizing any expenditure for capital outlay as recommended in the report, should carefully check to see if any unexpected changes have come about in the development of the community. A striking example of this was found in the St. Louis survey (114). A tract of 155 acres of open territory was zoned as residential and on the basis of this zoning and certain other factors, an elementary site was recommended adjacent to this tract. In less than two months the whole situation changed. A large industrial corporation bought this tract and some other property nearby as the location of a plant which would ultimately employ about 25,000 men. This resulted in the Zoning Commission changing this area from first residential to unrestricted industrial classification. These changes, of course, made it necessary to recast not only the recommendations affect-

ing the tract but others relating to junior and senior high school needs in that section of the city.

Changes in educational policy and method affecting size of class, course of study, size of units and type of organization should also be considered in their relation to the recommendations contained in a school building survey.

CHAPTER VIII

Research through Educational Tests

THE educational test movement, scarcely two decades old, may be said to have gone through three stages which may be described as the curiosity stage, the inspection stage, and the action stage. In the beginning, interest in the new tests was limited primarily to how they worked and why. Teachers and students trying out this new device, often either highly skeptical or unduly enthusiastic, like boys with fire-crackers, were concerned chiefly in discovering "what would happen". Naturally, little of consequence could happen from such use of tests.

The second or inspection phase of testing may be seen in the survey movement in which the chief use of tests was in connection with state and city surveys carried on by universities and other agencies. The standard test quickly was recognized as a sharp instrument for appraisal. In city and state surveys no more effective means has yet appeared to reveal educational status than the standardized educational test.

The third phase of the testing movement might be called the action stage in the sense that it is marked by serious attempts to outline an educational program in the light of results revealed by tests. While much educational testing is still in the second stage and some even in the first stage, the chief present emphasis is undoubtedly on the third phase. Genuine improvement of instruction based on test results has far-reaching implications and is largely responsible for the present almost universal activity in changing and revising courses of study. If one were to summarize the chief effect of the testing movement to date, one of the major contentions should rightly be that it has resulted in a consciousness of actual individual differences in pupils unrecognized or largely ignored before. The natural result of this conviction has been a movement away from traditional rigidity and toward flexibility and variety, in courses, in programs, in types of administration, and in equipment.

Moreover, the social upheavals which mark the present decade have led to a new and compelling emphasis on educational and vocational guidance in a broader sense of that term than in the past. Indeed in the more progressive schools it probably is true that the broad guidance function is now considered as important as the training function. Such testing programs as are under way in Minnesota, Iowa, Wisconsin, Providence, Baltimore, the Educational Records Bureau of New York, the Progressive Education Association, and in other places, are planned not only for the improvement of instruction but for their guidance implications. Such programs, says Wood¹

are based upon two important changes in professional consciousness: (1) a more adequate appreciation of the facts of individual differences, a more confident view of

¹A paper read before a special meeting of the National Education Association in Minneapolis, February 28, 1933. Most of the material in this paper was published in the February, 1933, issue of the *Review of Educational Research* (129:5-20, 62).

their compatibility with disciplinary and social ideas, and a more hopeful interpretation of their educational implications; and (2) a growing realization that social changes and the imminent new deal in economic life demand a new deal in the curriculum and the abandonment of many traditions maintained at least in part by vested interests and professional inertia.

We have begun to realize that the mere discovery of individual differences is not sufficient to improve education. We are learning that we must study and measure these differences as emphasized in living individuals and ascertain what they mean in terms of curriculum, teaching method, and aspirations of individual pupils. Meanwhile, during the past decade considerable progress has been made in the improvement of tests and their related technic. Knowledge of the nature and statistical implications of tests has spread rapidly throughout the nation. Following Thorndike's *An Introduction to the Theory of Mental and Social Measurements* (130) in 1913, a score or more of volumes on the technic of test construction and testing programs have appeared, and hundreds of studies, articles, and similar items of literature have been printed.¹

Major Strategy vs. Minor Tactics

In a consideration of the significance of educational tests in methods of research, it seems to us, at least, that we have come to a point where the first consideration must be what Wood (129:5) has aptly termed "major strategy as opposed to minor tactics". Improvement in the tests themselves, important though it be, is less important than the development of a rational philosophy in using them. Such a philosophy must be based first of all on a consideration of what the school should attempt to do for the pupil, and secondly, on the nature and limitations of the means at our disposal.

The major items that require attention are:

1. The development of a theory of testing that conceives of the task of educating each pupil as a process of guidance, in its broadest sense, quite as much as one of training.
2. The development of comparable systems for recording test results—integrated with all other available information—so devised that they will reveal in universally comparable units the *cumulative* educational history of every pupil.
3. The development of more adequate tests so constructed that they will yield more valid measures of the entire range of educational objectives, but above all in sufficient numbers of forms so that comparable results may be obtained over a period of years.

These are in reality but phases of the single broad concept of educational guidance. It is contended that the essential business of the school is to discover for each child what he *can* learn, and what will be *worthwhile* for him to *attempt* to learn. This can only be done through discovering his capacities, his strengths, his weaknesses, and his power of growth. No magic oracle is at hand to answer these questions. The complex machinery

¹A bibliography of 467 titles appears in the February, 1933, issue of the *Review of Educational Research* (129).

of present-day schools with their teachers, courses of study, devices for teaching, are our current method of accomplishing this purpose. Of all our devices for discovering abilities, the standard test ranks first. But unless tests are utilized intelligently, unless more adequate and comparable tests appear, and unless well planned long time programs of testing are substituted for the spasmodic opportunistic testing, which is *far too common*, we shall fail to capitalize our most promising instrument of research, and tests may fall into disrepute.

In the rush to utilize tests many worthless or even vicious results have been achieved quite as certainly as useful results. Tests and test procedures have naturally followed tradition. The old school examinations, college entrance examinations, and examinations for the passing or failing of students have been the pattern. The new type tests have been taken on for the most part as a new tool (of supposed superiority) to carry on the same old functions. But leaders in the testing field are challenging the whole theory underlying such procedures as there is evidence to show that it is based on questionable assumptions. Consider a single case, the traditional final examination. No single examination or standardized test as yet has been devised that can yield a true appraisal of a student's achievement in any course. The old institution of "cramming" alone is far too apt to defeat its purpose. But more serious still is the vicious theory that passing or failing is to be based on a single nervous ordeal such as a final test.

What the school should be interested in is the discovery and development of each pupil's actual, not artificial, strengths and weaknesses, as *cumulatively* revealed over a long time period. Indeed it is to be hoped that entrance examinations, finals, and all such may early be entirely replaced by *cumulative* records based on *comparable* measurements taken, more or less continuously, throughout a student's school career, or if vestiges of finals and entrance examinations must remain, that they be but single unemphasized links in the longer chain of evidence which tells the actual story. If any tenet of guidance has been established, is it not that the way toward success lies in the development of *strengths* rather than weaknesses? Yet who shall estimate the time, energy, and wealth that is annually being squandered through requiring students to take and retake school subjects in which they are excelled after all their efforts by 70 to 99 percent of their competitors? Too often we as teachers tend to assume that credit must as a matter of course be arrogated to ourselves if our pupil "shows growth" in the particular thing we are attempting to teach him, blind to the fact that *that* growth may be so infinitesimal and achieved at such cost as to make it not only imminently profitless but pernicious—if it can be shown that the same time and energy spent in more hopeful directions will yield truly meaningful results.

The fact that we have set up an array of subjectmatter that we refer to as "minimum essentials" or "required courses" or "entrance requirements" does not condone our blind attempts to cram unsuitable subjectmatter into heads which cannot take it. Is it not time that we should bring whatever

resources we possess to bear in more effective ways on the broader aspects of guidance, i.e., upon discovering what pupils *can* learn?

More than ever before the school today is called upon to be the daytime parent and guardian of its pupils. Parents justifiably turn to the school as the major agency for counsel and direction in dealing with the educational development of their children. From the first day in kindergarten through primary, intermediate, junior and senior high school grades, child and parent come in increasing degree to the school for guidance in providing that education which shall result in the best possible mental and physical welfare of the child. If we are to discover the real capacities of our pupils, and if we hope to do anything about it we must devise more effective ways of utilizing, of synthesizing our knowledge of each pupil's capacities. Present-day school records are too frequently a miscellany of meager unrelated items expressed in uncomparable terms. Yielding to the notion that teachers must not spend time in recording results since their function is to teach, we frequently lose what we have gained in the attempt to learn the real characteristics of students and thus to guide them intelligently through their school career. The fault is not with the teachers but with our failure first to grasp the significance of adequate records, and second, our failure to provide effective means for accomplishing this purpose.

A system of adequate cumulative records, giving the educational life story for every child—year after year—in recurring, comparable, meaningful terms, based on scientifically constructed measurements, together with vital items of personal history, intelligently used, has potentialities which have as yet been scarcely touched. We have too long been content to give our attention to the minor tactics of diagnosing individual weaknesses. Important as these are, there are major issues of even greater portent. What shall it profit us if by stint of terrific effort and many failures, a student finally passes a subject which by that very fact proclaims it as his weakness, if we have failed to discover his strengths, and thus have omitted developing in him that in which he really gives promise of excellence?

Education which lays any claim to providing intelligent guidance and which hopes to rest even partially on scientific bases must use as its very cornerstone a system of cumulating, meaningful records that more than any other device will serve as chart and compass in the educational direction of every pupil. But before we can arrive at such a consummation there must be built up in the minds of every teacher, principal, and administrative officer, a totally different concept from the typical miscellany which now passes for school records. In their place there must be a comprehensive year by year chronicle that shall reveal with cumulative authority what each child *can* do, what he *has* done, and hence what he may hope to do in terms that are universal, comparable, and hence meaningful. Chief among the indexes which it will carry will be the results of tests—ample, numerous, cumulating, expressed in comparable terms, year by year. So also will be expressed the cumulating estimates by his teachers.

The most promising type of school records which has come to our attention is that recently developed by the Cooperative Test Service of the American Council on Education (124:1-6). This type of record admirably meets the specifications here demanded. However, no attempt is here being made to "sell" any particular brand of record card, but only to set forth the essential features which any adequate record must have.

Needed Improvement in Standardized Tests

It is precisely because of the great difficulty of obtaining an adequate, valid, and reliable mental measure of a child that provision must be made for cumulatively recording all results obtained. A few principles of measurement have been established. We know that two equally valid tests are more trustworthy than one, that three are more valid than two. This fact, which can readily be demonstrated, need not be defended here. But unless the test of 1929 is expressed in terms comparable with that of 1930 and 1931, the results remain mere isolated and unrelated facts. Moreover, if results in one subject are expressed in terms uncomparable with those in another subject, the value of tests is largely lost. Unless the total mass of test results, teachers' marks, special examinations, outstanding events in the pupil's life, can be woven together into one meaningful fabric of related data, we fail to utilize our resources.

More kinds of tests are needed. To the extent that valid, reliable, and objective measures become available in all phases of education, a balanced emphasis in teaching will tend to be maintained. Intelligent observers are realizing that while standardized tests have helped to find and sometimes to solve educational problems, they have at the same time created a teaching problem of considerable consequence. That problem is how to avoid giving the test makers control of what is being taught. The course of study purports to record what is to be taught, but teachers teach to meet the requirements of tests. A program calling for initial and final testing causes the teacher to prepare carefully and to emphasize the subjects in which tests are administered (128:1). Even the methods of pupils and of teachers may be effected by the form and content of tests. These effects of educational tests demand attention from the test makers. One part of the solution lies in the creation of broader tests. Tests are sorely needed for a wider range of educational objectives including appreciations, attitudes, morals, manners, skills, and understandings (129). To the extent that these measures can be constructed cooperatively and on the comparable basis described above, tests will become an increasingly important factor in determining and evaluating administrative policies, of setting up objectives and evaluating the products of the educational program, evaluating methods of teaching, and improving learning through a discovery of learning difficulty, the sources of motivation, and the uses of self-teaching test materials.

A recurring criticism of the available standardized tests is that while they may measure what they purport to measure, their scope is nevertheless too limited. For institutions and individuals who feel dissatisfied with a

given test because of questioning the objectives measured in the test, a plan of having carefully constructed tests on each of the major objectives in a subject permits of different weights being assigned to each test (131:288). When, moreover, such tests are prepared cooperatively, as for the Iowa Every Pupil Test program, the American Council on Education, and the Educational Records Bureau of New York, the advantages of the standardized test can be retained without solidifying educational procedures.

Another aspect of the improvement of the standardized test in which research is under way is that concerning the technic of selection of test items. Lindquist and Anderson (126) investigated very thoroughly this problem as applied to the general achievement test. They recognize that this type of test is designed to express, in terms of a single score, a pupil's relative achievement in a general field of subjectmatter. They recommend that the general achievement test should avoid the appearance of encouraging the continuance of the status quo in curriculum content, thereby constituting a hindrance to progress and improvement in curriculum building. These tests, they claim, should be based on the most advanced and approved content available, that is, the subjectmatter common to the best books and courses of study now in use with the major emphasis on reasoned understanding of the content rather than upon the factual content itself. The validity of the whole test depends upon the degree to which it ranks pupils in the order of their total achievement. The worth or effectiveness of the test item rests not only upon its desirability for inclusion in the curriculum but also upon its power to discriminate between pupils of high and low levels of general achievement.

Other problems concerned with establishing the validity and the reliability of test items merit continued study. Ruch and Stoddard (127:48-51, 301-28) summarized the methods of test validation with especial attention to the procedure of "correlation with criteria". Holzinger (125) derived certain new formulas for giving the standard error of response of a single test item. A study of the effect of a time limit on test scores has yielded the conclusion that in tests of appreciation no time limit should be set (128). A comparison of the listening to the examiner's oral reading versus the silent reading method of taking a test in the appreciation of literature demonstrated that the "listening method" secured more reliable measures of the literary appreciation of six- to ten-year old children (123). The low coefficients of correlation between the available prognostic tests and success in the field measured indicate a need for further job analyses and for tests in the subtler aspects of success, including determination to succeed, willingness to sacrifice immediate comfort for ultimate success, physical attractiveness, and other items not closely related to mere abilities and skills. Traub's investigations (129:41-48, 72-74) in the field of guidance and placement provoke the conclusion that industry and education are gradually learning that it is much safer to rely upon objective measures of present ability than upon mere records of time served at a certain type of work.

Summary

Educational tests are probably the sharpest of all the tools of research. But they can easily be so misused as to yield not only trifling but even harmful results. Piecemeal, spasmodic testing, with tests of doubtful validity even though they be "standardized," is of meager worth. The very frailty of this new but incisive instrument in education demands that every possible ingenuity be exercised in their use so as to strengthen their total effectiveness. Continuous programs of recurring, comparable tests, recorded in comparable terms, is one telling way to capitalize the potential usefulness of tests. But even more important than this is a more general acceptance of a theory of testing in which the major aim becomes broad long term guidance as well as training. Such guidance must be based to the greatest extent possible upon factual evidence furnished by repeated use of the most valid tests available, generously supplemented by other and personal facts which vitally influence each given pupil's career. To reach this consummation, there is need also for much improvement in the educational test itself. In particular, many more comparable forms of achievement and other tests should be available. It is to be hoped also that tests of the more subtle objectives of curriculums may soon be developed despite the apparent difficulties involved, and that more defensible methods for combining teachers' marks, character traits, and personality ratings with long range recurring test results will be made a major objective of the specialists in the testing movement.

CHAPTER IX

Methods of Research in Child Psychology

IN this brief section the methods of attack on various problems in child psychology will be described and illustrated in terms of current procedures rather than through their historical development. Although a project of any scope is likely to cut across several specific methods, it will nevertheless be helpful to distinguish the following: observational, rating, experimental, test, questionnaire, clinical, introspective, and psychoanalytic.

Observational Method

Any method is likely to involve observation as a preliminary or supplementary device. However, the method consisting primarily of watching child behavior in unmanaged situations has proved exceedingly popular in child study.

Form of recording—In the past such records consisted of omnibus accounts of everything the child did or said over long periods of minute observation. Voluminous data resulted which were unique for the child being observed. These sometimes led to improved insights on the part of the person doing the recording, but they did not contribute much to the working out of a scientific approach. More recently such records are used by way of liaison, while the main effort is placed in constructing a suitable record blank. Some of these record blanks have been highly developed with symbols taking the place of sentences or words. See, for example, the work of Beaver (134) and Barker (133). It is increasingly common also to spend more time defining exactly what is to be observed, whether it be a unit of behavior, a trait, or an attitude. Two or more observers are frequently used, sometimes simultaneously, in order to get a check on reliability. Examples of this more rigorous treatment are contained in Hagman's study (147) of companionships of preschool children, and Arrington's work (132:20) on behavior.

Time units of observation—An important question which is being raised increasingly is, of what does an adequate time-sampling consist in work with children? Should we have long samples of continuous behavior, or should we break them up into small samplings, perhaps utilizing many children and a number of observers? Goodenough (144) has shown that fairly reliable observations can be made with units as short as ten to fifteen seconds. Other observers such as Hagman (147) have defined the unit psychologically; for example, at any moment it may be determined whether a child is reacting to another child in the group. In some cases, the time unit is attached to a physical arrangement, such as one minute observations of the use of a sand-box or other piece of play apparatus.

Modifying external conditions—It is not always desirable to record the child's behavior while the adult is in the picture. To avoid this difficulty, various observation screens have been devised, particularly following the

lead of Gesell (142) at the Yale Psycho-Clinic. Screens can be arranged so as to secure one-way vision. Another modification lies in controlling the child's companions at the time of observation. This is often accomplished by observing the child only in a nursery school laboratory or in a group selected from such companions. The work of Berne (135) in observing the social behavior of children, and of Jack (150) on ascendant behavior in the preschool child approach the experimental method. They may, in fact, be considered the border-line between semicontrolled record taking and rigid experimental technic.

Advantages and limitations—The observational method used to be popular because it required no preparation and no apparatus. One simply watched the child and the amount he was able to select and observe accurately was dictated by his conscience or his genius. But the limitations of this technic are fairly obvious. We know that even two skillful observers cannot come out with the same facts under such a blue-sky system of selection and report. Moreover, many of the phenomena we need to observe do not arise in a particular situation. From the standpoint of economy and time they must be stimulated. Then there are insurmountable difficulties in trying to treat narrative accounts statistically.

The Rating Method

In this method, some characteristic or trait, or perhaps the "whole child," is rated or ranked, usually in comparison with some previously arranged set of grades or steps. The method has not been as common with young children as with adolescents and adults. Examples of its application to the younger ages will be found in the work of Marston (157), Berne (135), and Conrad (139).

Advantages and limitations—A rating scheme upon which careful work has been done in advance of the immediate research problem has the advantage of covering a wide range of items in a short time. For such noncrystallized characteristics as personality traits it still has a place, but it is subject to errors of judgment and personal bias, and to variations which may arise in the interpretation of subitems. It is also heavily dependent on memory. Conrad (138:291), in a recent study, does not hold the personal bias question to be a serious limitation. He states, "If ratings are to be rejected as a legitimate technic in scientific psychology, they cannot at present be rejected on the ground of the 'personal equation'." Other difficulties arise in getting raters to agree upon the meaning of items as well as the degree of their presence in the situation under observation. Raters often vary in reliability on going from child to child.

The Experimental Method

The experimental method in child psychology, in common with this method elsewhere, seeks to secure responses under conditions which are controlled, modifiable, and reproducible. As a rule, apparatus is employed,

but this is not an essential characteristic of the method. It differs from controlled observation in that the child's response is limited or obtained along certain predetermined lines. The child is no longer a free agent except within the framework of the experiment. Of course such control, particularly with younger children, is relative. The aim is to get as many factors alike as possible in order to permit only variations along the lines which are being measured and studied. For example, Hicks (148) was able to maintain fifteen points of approximate equality as between a control and an experimental group.

A test may be used in an experimental situation, but it is here comparable to a tool or a piece of apparatus. It may, for example, be a means of equating groups which are then to be subjected to differential stimulation or modification. The test may give preliminary evidence, may measure variation of growth during the course of the experiment, and may be used finally as one means of indicating what changes have taken place.

Similarly, observations may be a part of the experimental procedure, perhaps as a supplement to the more objective or mechanical records. Increasingly, the experimental methods with even very young children tend to resemble those in more familiar branches of laboratory or experimental psychology. This is well illustrated in the work of Updegraff (164). She found that children could be depended upon as observers both from the standpoint of interest and reliability. Similarly, the work of Chase (137) on motivation turned essentially about devising a piece of apparatus which would furnish a good control over the child's physical response to various forms and degrees of incentives. The construction and validation of such an instrument for preschool children proved entirely feasible. An illustration of the increasing use of laboratory technics by experimenters in this field is contained in the work of the late Professor Weiss and his associates at Ohio State University (149, 161). By means of a cabinet, the newborn infant can be placed in a situation with accurate controls on heat, light, humidity, and sound. Such an arrangement lends itself readily to observational and experimental technic.

Advantages and limitations—The advantages of experimental procedures, when they are appropriate to the main demands of the project, do not need elaboration in this review. It is sufficient to say that this method is economical in time and that it affords a control over isolated factors not given to any other method. It lends itself to statistical manipulation in determining the validity and reliability of observations. It provides a hard nucleus about which may be woven many less objective observations of child behavior. In this way, a more reliable and complete understanding of the child is achieved.

The method has been considered by some as artificial and unnecessarily restrictive. It seems lean and rigid to many people who have a gift for observing in detail the "complete picture" of a child's activity. Such persons have a feeling that experimental situations are unnatural. But it is

clear that there is nothing natural about the ordinary home or school situation; we have simply become used to it. It can be established that a child may feel as free and unrestrained in a little testing room, either by himself or with another child, as he does in regular play-time activity. Of course one is limited in the amount of information to be acquired by experimental exploration. The "whole child" may not be in the picture. This should be accepted as a necessary limitation, in the same sense that the whole of chemistry is not in the test tube containing the results of a particular reaction between two compounds. But if experiments are planned with a large design or pattern in view, it appears feasible to coordinate their findings into a meaningful and valuable whole.

The Test Method

The test method needs little introduction to students of education. In child psychology, tests are likely to be used in an auxiliary way (see discussion of the experimental method). Typical examples of this method are the studies by Goodenough (145) on the reliability and validity of the Wallin peg boards, by Larson (154) on the Seashore tests of musical talent, and by Strachan (163) on the distribution of intelligence quotients.

Advantages and limitations—The advantages of the use of tests have already been given by implication. It is often essential to get as good a measurement as possible of the mental level or brightness of the child. In normative and comparative studies, the results of tests lend themselves to accurate statistical treatment. There is sometimes a tendency to regard the test as too complete a measure of what it is designed for; to give an intelligence test, let us say, and assume that we have all that we need to know about the mental capacity or growth of the children under investigation. Such an assumption is fallacious, particularly with very young children where the mental tests are still in a highly formative stage.

The Questionnaire Method

The questionnaire method has been popular since the days of G. Stanley Hall. It may consist of a list of questions sent out to a number of persons, or of questions to be asked during an interview. In the latter case the investigator usually records replies during the interview. The questionnaire method in its earlier, cruder forms attracted a great amount of justifiable criticism, and it may be said that most questionnaires today are still to be looked upon with suspicion. However, some recent developments may lift the questionnaire, or at least the questioning technic, to a new level of usefulness. Betts (136), for example, has developed a system of electrical recording consisting of a microphone, amplifier, and dictaphone which has a very high degree of accuracy. Such an arrangement permits of great flexibility in the conference between child and experimenter and reduces the social tension. Grigsby (146) used this method in undertaking a rather intimate exploration of the concepts of preschool children. Lehman and

Witty's (155) use of the questionnaire in investigating children's play activities is also indicative of present-day procedure. *

Advantages and limitations—The questionnaire method often saves time. Where the questions are carefully prepared and the sampling of persons is chosen for relevancy and cooperativeness, the method has some value. The great difficulties arise in interpreting the meanings of questions. Also there is not enough attention paid to the selection involved in a partial return of the total number of questionnaires sent out. That the personal bias of so-called competent investigators may color questionnaire results is shown by Rice (162).

The Clinical Method

The clinical method has a limited use in the normal range of behavior. It may be taken to include the case history method, together with whatever diagnostic tests the clinician wishes to have given. On the basis of a rather heterogeneous picture consisting of tests, health record, medical examination, social history, and personal and social status, a generalized account of the individual is built up. It is not so much a method of research as a method of individual diagnosis and treatment. Nevertheless, the method needs mention here, for there is a tendency on the part of professional people to consider such materials as objective and reliable data for research purposes.

Advantages and limitations—The advantages lie in the immediate and long-time help to the child or patient, and this in turn appears to be heavily weighted by the skill and experience of the clinician. But it is almost impossible to treat most case histories as scientific data because each set of materials contains so much of the peculiar ability, attitude, or even prejudice of the person who assembled it. Even for normative items in infant and child development, which one might think to be rather easily transferable to average workers, Gesell (142) states that they are only reliable in the hands of clinical experts who know infants at every stage of their development.

The Introspective Method

Introspective technics have a very restricted usefulness in child psychology. However, Klüver (153) has been able to employ it somewhat in his study of eidetic imagery.

Advantages and limitations—Introspection appears to be a rather mature process, and one difficult to equate as between child and adult. Our vocabularies, with their fine shades of meaning based on life experience, enable us to build up introspective patterns which are denied to very young children. Moreover, children are likely to cover up, by laconic replies, the actions and conditions to which they may respond most deeply.

The Psychoanalytic Method

Thus far, the psychoanalytic method, like the clinical method, has been built up chiefly as a service to child adjustment. But in the last few years, there has been a tendency toward more carefully controlled inquiries by this technic. The work of Lewis (156), Freud (141), and Klein (152) in this field is typical. They conduct what might be called subtle interviews with the child, and sometimes with the parents, in order to throw light on the child's past experiences.

Advantages and limitations—It is too early to say how much can be done with children along these lines, but it seems reasonable to suppose that well-trained psychiatrists may be able to explore children's reactions in terms of their past experiences with increasingly fruitful results. Certainly some technic is needed to add the third dimension of experiences in time to a child's world which, in present-day scientific literature, consists too largely of immediate place and stimulus-response dimensions. The psychoanalytic approach may possibly reenforce a thoroughgoing genetic study of the child.

Further Aspects of Method

In the common cross-sectional method of selecting a sampling, trends as between groups may be studied. However the longitudinal approach, whereby children are brought in for repeated measurements or experiments over a long period of time, holds certain values which are lost in the cross-sectional scheme. The longitudinal or genetic approach simplifies the statistical problems immensely and may result in certain unique discoveries. An example of this is the recent work of Wellman (165) on increases in intelligence quotients among children who attended preschools. Control groups are often employed in which the essential variables, except the one at the center of the study, are equated. This method may be employed in combination with either the cross-sectional or longitudinal approach. A recent example of its utilization is contained in the work of Jersild (151) in studying the relative influence of learning and maturation. In some cases the experimental and control groups consist of one twin each. This is known as the method of co-twin control. Usually the twins selected for such comparisons are considered identical, and there is a further assumption that identical heredity will result in equivalent children provided environmental conditions are constant for both. Examples of studies utilizing this method are those of Gesell and Thompson (143) and Newman (158, 159, 160). One of the chief difficulties with this method arises from the great reliance which must be placed on a few measurements of only two individuals. The more extensive use of such methods involving a sufficient number of cases for statistical treatment is found in Freeman's recent report (140) of the modifiability of intelligence.

In the classification of methods given above, statistical treatment is not considered as a separate category, for statistical technics may be applied

to any of these methods provided the sampling and the units of measurement are appropriate.

It is not possible in this generalized description to rank the methods or to indicate which are appropriate for specific types of studies. Certainly there is no one best technic for all purposes. Nor need the study of children be confined to approaches which may be designated objective or scientific. Only if the immediate and final ends of the problem at hand are scientific in essence do we need to be concerned about the nature of published reports. If the writer or researcher states that such and such results and conclusions are established, not only for this child but for children in general (or at least for children within a defined category), then we are forced to look into his method. In so doing we must be sensitive, not only to the adequacy of his detailed steps, but to the appropriateness of the general procedure or method which has been selected.

CHAPTER X

Methods of Research in Pupil Personnel, Guidance, and Counseling

PROBLEMS in this field center around school attendance, the progress of children in school, rating pupils, making records of and reporting data concerning school children, studying their major characteristics—personal, physical, mental, and social—and evaluating methods of caring for these differences through counseling and guidance, extracurriculum activities, special schools and classes, and various administrative adjustments which are provided within the regular day schools.

School Attendance

Questions may be raised pertaining to its amount and causes of non-attendance, means of attendance enforcement, effectiveness of good attendance, and attendance service costs. The methods used to answer the questions are varied and the need for improvement in research methods is great.

Amount of attendance—Research rarely extends beyond the assembling of data reported by teachers respecting enrolment and attendance. These facts from local school districts are assembled by both the state and the federal offices of education. They may be gathered from the annual reports of various public school systems. Occasionally an individual or some organization tries to secure more trustworthy and comparable data by means of a special survey made in person by the interested individual or by means of a questionnaire. In order to judge the extent of enrolment and attendance, investigators usually attempt to secure census figures which will show the number of youths of compulsory school age.

Numerous difficulties stand in the way of research in this field. Terminology is not agreed upon. What is meant by a day of attendance? What does enrolment mean? Methods of reporting differ; some report by grades, by ages, or by both methods; others report these facts en masse. Age groups which are enumerated vary; compulsory attendance ages vary; these variations make the setting up of comparisons extremely difficult.

If research is to be facilitated a common terminology must be adopted; data for nationwide comparisons must be recorded and reported uniformly; plans must be devised to eliminate errors such as duplicate enrolments and inaccuracies in school census data; the United States Office of Education should be responsible for and should be given the power to make changes which would insure correct and comparable data from all school districts within the United States.

Causes of non-attendance—A great amount of research dealing with causes of non-attendance has been based upon the reports of parents or of pupils as to why the absence occurred. It is assumed that they report correctly. Marksby (168) showed that this assumption is frequently not

valid. Parents report incorrectly sometimes to protect the child, sometimes to protect themselves.

Another method, occasionally used, is to relate the amount of attendance to such factors as kind of home, kind of school, preparation of teacher, school marks received, amount of retardation, distance from school, and mental ability; by the partial correlation technic, each factor is related to attendance when all other factors are held constant. Those factors having the highest correlation are assumed to be the chief causes. The problem facing the research worker is that of securing accurate measures of each of the factors which may have a possible bearing on non-attendance. This often means that some factors which common sense suggests as real causes have to be ignored. These studies, while important in the study of pupils in the mass, fail to specify the causes of non-attendance for a given child.

The case study technic has been used in studying causes of truancy by Healy (167); it could profitably be used in a study of causes of non-attendance. It is to be hoped that as the qualifications of attendance officers are raised and as visiting teacher service becomes an accepted function of the schools that the case study method will become more and more the vogue in studies of causes of non-attendance.

Enforcement of attendance—Research in this field has been largely descriptive. Studies have been made of the organization of enforcement departments, of devices used to improve attendance, of how the school census has been utilized in enforcement, of the qualifications of attendance officials, and of the general attitude of enforcement officials toward the problem of improving attendance. These studies are interesting but they are of little or no help in deciding what to do. The local superintendent is still forced to adopt policies without specific information being available as to their effectiveness. We need experimentation which will indicate the degree of effectiveness of various policies and methods for improving attendance. Maybe, as some suggest, our whole organization for improving attendance is a useless expenditure which, if used in directly improving instruction, might be much more effective in securing attendance; experimental research is needed.

Other problems—The effectiveness of compulsory attendance legislation and of good attendance has been studied by means of simple correlations. The multiple correlation technic would have made the results much more impressive had the same coefficient of correlation been secured by both methods.

The cost of attendance service has been seldom studied; it should be given considerable attention. A study of per pupil costs, however, will mean very little unless the costs are interpreted in terms of the services rendered. One city, paying half the per pupil costs of another, may actually be paying twice as much as the latter in terms of services received.

The history of compulsory school attendance has been studied by a number of students; most of the studies center about the development in

England, Germany, and Massachusetts. There is an opportunity to study this development in most other foreign countries as well as in each of the forty-eight states; in addition to the obvious data concerning such developments, there ought to be attempts made to reconstruct the influences pro and con which operated to provide just the legislation which is at present in force.

Research needs—Uniformity in terminology and uniformity in recording and reporting enrolment and attendance data are needed if research is to be most effective. Experimental research as well as a case study type of research is needed to supplement the descriptive research so frequently used. There is a real need for research workers to check the effectiveness of administrative procedures proposed in dealing with the various problems of this field.

School Progress

These studies attempt to discover the rate at which pupils complete the regular grades, the grades at which they leave school, and the factors that affect both rate and elimination.

Rate—The age-grade study was the earliest method used in attempting to determine rate of progress; a distribution of the ages of all pupils of given grades was made, showing the number of pupils of each age within each grade. Assuming certain ages as normal for each grade, all older children were overage and those younger were underage. It was assumed that overageness represented slow progress and that underageness was rapid progress. These studies are still generally made. Their fundamental weakness lies in the fact that they must assume that all children enter school at the normal age if overageness is to approximate slow progress; they must assume further that there has been no dropping out of school for a half year or a year or more after once entering. Age-grade studies thus far have seldom been comparable, due to differences in normal age, in methods of figuring age, and in times of the year at which studies were made.

More recently the grade-progress study has been made. It involves a distribution by grades of the number of years a child has been in attendance at school; zero years of attendance is normal for entering grade one; one year for entering grade two, and two years attendance for entering grade three. A pupil has progressed normally if he has averaged just one year per grade; if he has taken longer he is progressing slowly; if he takes less than that he is progressing rapidly.

The chief difficulty, and a serious one, is that pupil cumulative records are so inadequately kept from the first grade that the needed information is often not available; this is undoubtedly the reason for the continuance of the older and less accurate method of study. Another difficulty lies in the lack of agreement as to what constitutes a year of attendance at school. Is attendance at kindergarten to be counted? If a child enrolls and at the end of the month takes sick and remains out of school for the remainder of the

term is he to be counted as attending or not attending? These latter difficulties are less serious, however, than the problems faced in getting comparable age-grade data.

Promotion rates are also studied; this is done by determining year by year the percent of failures; these percents are distributed by schools, by teachers, and by grades. These studies do not give a complete picture of progress for the school up to date but they do give a picture of the extent of normal progress for a given term or year. These studies also lack comparability due to lack of agreement as to who are the failures. If a child drops a course or is demoted during the term is he to be counted as a failure; if so, when? If a child is conditionally promoted and is returned to the grade after a trial who counts him as a failure? If a child is doubled and is later sent back to his normal grade is he counted as a failure? Lack of agreement on these questions makes it impossible to secure comparable data.

Elimination—The simplest and still the most common method of determining elimination is to compare the enrolments of successive grades. Ayres (166), Strayer (170), and Thorndike (171) figured the percent which each successive grade enrolment was of an estimated first grade enrolment; they differed in their method of determining this true first grade enrolment and as a result differed considerably in their estimates of elimination.

These investigators recognized the inaccuracies of these estimates at that time. Thorndike suggested that cumulative records be kept which would give a complete picture of what children do from the time they enter school until they leave school permanently. This suggestion made about a quarter of a century ago is just in the process of being realized. The next quarter century should see considerable improvement in the accuracy of elimination studies.

Factors involved—The causes of a slow rate of progress or of early elimination have been studied by resorting to the opinion of the pupils themselves, to the opinion of parents, and to the judgment of teachers. In a few instances the correlation technic, both simple and partial, has been used. In each instance we find the same fundamental difficulties that were found in using these methods in the study of causes of non-attendance.

Causes of school failure or slow progress and of elimination are extremely involved. The causes in any two cases are no more identical than are the characteristics of the children in question or the environments that surround these youths. Each and every case is a problem by itself; as a method of study, therefore, the case study technic should be used more frequently in analyzing causes of pupil failure and elimination.

School Marks

Problems relating to school marks have to do with how grades are distributed, what is their reliability, what factors are involved in giving them, and what are the various systems of marking.

Distribution—The method is very simple; the investigator makes distributions of the marks given by different teachers, in different subjects, and in different schools. The variability has been found to be very great. As pointed out in discussing progress, these distributions usually ignore those pupils who dropped out of the class before the term closed due to the fact that they were doing poor or failing work; they also ignore as failures those who were promoted conditionally and were later sent back.

Reliability—This has been a favorite study of those interested in school marks. An examination paper is reproduced and sent to a large number of teachers who are expert in the field. They are told to rate the paper on the basis of one hundred for a perfect paper. A slight deviation from this procedure is to have the same people remark the paper on successive occasions without knowing in advance that they will be expected to do so. These experiments have been tried frequently and with monotonously similar results. The reliability of a single mark by one marker is quite low.

Perhaps, however, the method is not the best way of testing the reliability of marks; the situation faced by the marker is not the same as that which he faces in marking an entire set of papers. It would be interesting to have results of an experiment in which the markers each had to mark an entire class group of some forty papers. What would be the variability of the median scores as well as the variability of the scores on individual papers? Would, under these conditions, the individual papers vary as much as they have been found to vary in previous experiments?

Factors affecting marks—The usual method has been to list possible factors on a questionnaire and ask those taking part to check factors which they take into account in giving marks. Other students by simple correlations relate various factors to school marks. Others compare distributions of marks given by teachers not supervised with distributions given by well supervised teachers; variability seems to be much less among the supervised group. Others give standard tests and compare the resulting scores with the distribution of marks given by different teachers in various schools; this shows that schools which failed none by the teachers' marks failed 20 percent or more by the objective tests and vice versa; this was taken to imply that teachers hold vastly different standards of what constitutes good or poor work and that the standard held is a large factor in the giving of marks.

Recording and Reporting

Careful research in this field is scarce; research of a more or less superficial type is abundant. The problem which has perhaps been given most attention is that of selecting items which should be recorded and reported.

Items to be recorded—The most general approach has been to collect record forms from many school systems. The investigator examines these forms more or less carefully and in the light of his own theory subjectively decides which items are necessary.

Others have collected forms and have had these forms discussed by groups of interested individuals; the group has sometimes set up general principles to guide them in arriving at decisions; more frequently the resulting system has been arrived at as a result of concessions upon the part of all members of the group to the whims of the various individual members.

Frequently systems have been devised by an individual, more or less skilled, who used one or the other of the above technics; the system has then been *tried out*. The try-out, however, is usually not tested objectively but merely by the subjective opinion of the users; since the users are generally subordinates to the deviser of the system, the results reported are frequently favorable.

A few studies, involving the frequency of the occurrence of items on records and the frequency of need for the item, have been made. Frequency of occurrence involves the collection of record forms and the counting of how frequently each item occurs upon the forms. The frequency of need involves several technics. It may require a count of the frequency of the use of the item by teachers, principals, and other school officials; it may demand a count of the frequency with which the item is needed in making studies or investigations in the field of pupil personnel or of general school administration; it may involve a count of the frequency with which an item is needed in making the reports required by school officials or by state law.

A few studies have secured extensive lists of items which are being recorded. The investigator has then sought by questionnaire an appraisal of the various items by men supposedly expert in the field. Seemingly no attempts have been made to determine the best items through some method of controlled experimentation.

Problems in need of research—In addition to determining the items which should be recorded we need some help in answering the following questions. How should the required items be collected? When should these items be assembled? Into what units should they be arranged? What should be the character of the forms upon which these items are assembled? What codes if any should be used? Is there any given arrangement of items upon a form which will make for efficiency in the use of the form? Administratively, how are the record forms to be used—to whom are they to be accessible—how is that accessibility to be best attained? Just how is the teacher to best utilize the information that the record makes available to her? Are there any technics whereby the teacher may be aided in making maximum use of these pupil records, or is each teacher to be allowed to use or to ignore the record just as she sees fit? If there are technics what are they? These are a few of the problems which need solution in this field. Research seems noted for its scarcity rather than its abundance.

Characteristics of Pupil Population

Before adequate records of the individual can be maintained we must measure as objectively as possible the various traits of pupils. These traits

or characteristics of the pupil population include such items as intellectual ability, mechanical ability, social ability, and physical ability; they also include character traits such as honesty, perseverance, and industry. The ability of pupils to achieve in schools as represented by school marks is a part of the problem of knowing the school population.

Standard tests—During the past two decades, tremendous impetus has been given to the study of pupil characteristics through the development of standard tests. The academic ability and academic achievement of pupils as determined by such tests have been determined; this has been done upon such a large scale that we now know what achievement, on the average, to expect of pupils of given grades. The results of these intelligence and subjectmatter tests have made possible the comparison of pupils by sex, age, grade, race, and nationality.

Tests of physical and mechanical ability have likewise been developed and used to measure these traits. There is a great need for developing more accurate tests, however, in both of these fields; there is also a need for popularizing them so that they can be used as widely and as intelligently as tests of subjectmatter.

Rating scales—The rating scale has been used in the study of social ability or of the so-called character traits; in some instances tests have been used but they have not been very effective. Rating scales have been of several types. One type asks the rater to think of the best and the worst individual he has ever known with respect to a given trait; then he thinks of the average individual; then individuals half way between the average and the extreme individuals are chosen. Those being measured are rated with reference to this scale.

Another type of scale has descriptive expressions which define the various points on the scale; all traits are listed upon a single sheet and the sheet is used for a single individual. The third type uses the descriptive expressions but uses one sheet for a single trait and may rate forty people upon that trait on the one sheet.

The needs of research—They are essentially two. We need further research in the devising of better instruments for research in this field. Measuring instruments for character traits are extremely unreliable and yet the development of such traits in pupils is perhaps the most important aim in the whole program of public education. Measures of ability in various and specific vocations are scarce and yet perhaps there is no other single measurement which is as important, during this period of unemployment and readjustment as such measures.

In February, 1933 there was established in New York a service known as *Adjustment Service*. Its job is to study the individual who seeks this service and to discover the type of job for which he has a special ability. It is finding that the unemployed who come for aid have been for the most part misfits; they are people who have been in a job which they hate and yet could not leave; the depression came and they were the first to be fired.

This service emphasizes the need of similar services in the public school; we need to popularize the work of adjustment service so that it becomes a regular part of a public school program. A research program which aims to know every public school pupil should be constantly maintained. Such a program will make it more and more possible for the child to step from school into a life job with little or no break in the making of the change.

Guidance and Counseling

Research dealing with records and with a study of pupil characteristics is the basis of effective work in guidance and counseling; research in those fields is, therefore, equally applicable to this. In addition we are interested in a great many problems related to the formal organization necessary for the administration of guidance and counseling and in field studies which such departments need to make if their work is to be most effective.

The survey—A number of researches in this field have been of the survey type; in some instances questionnaires have been sent to public school officials in an attempt to gather data concerning the organization and supervision of guidance programs; in other instances, the investigator has studied at first hand a limited number of systems having organized guidance. These studies provide data concerning what is being done; they do not give the best of help with regard to what should be done.

Another type of survey is being constantly maintained by many guidance and counseling bureaus. Each member of the department is required to make yearly a study of some one vocation within the city in order to constantly have up-to-date and first-hand data concerning the various vocations of that city. This is done by personal visitation; the investigator has prepared in advance an extensive list of the facts which he wants to assemble. He sees to it that these facts are secured by interviewing the necessary officials of a given trade or industry.

The follow-up—This is done by some guidance bureaus in order to have data which will show to some extent the effectiveness of guidance and which will assist the members of the staff in making their work more valuable through the discovery of present weaknesses. This follow-up maintains a permanent follow-up record or folder for each graduate; this is kept up-to-date by voluntary reports from class members as to what they are doing and how they are getting along plus replies to letters which the school sends out at stated intervals to those who have not reported. Data are likewise collected from relatives, employers, and friends.

We need more of these follow-up studies; money is being expended in no inconsiderable amount to make possible guidance programs. Are they worth while? Do we have evidence that such money is being well spent? It ought not to be difficult to justify the spending of money necessary to indicate whether or not the service is worthwhile.

Further research—In addition to determining the effectiveness of the program, we need to know which of several programs seem to be the most

effective. Do we know, for example, just how much more efficient the *composite type of organization* is over some other method of organizing our guidance work? How many pupils can a class counselor care for and still do good work? How are we to distinguish between the function of the classroom teacher, the function of the class counselor, and the function of the homeroom teacher in a guidance program? What should be the specific qualifications of a class counselor, of a director of guidance, and of a teacher who is to have guidance responsibilities? Are we merely to dismiss these problems with the suggestion that they are matters of opinion?

Extracurriculum Activities

The problems most frequently dealt with are: How are these activities to be administered? What is the relation of them to such factors as intelligence and scholarship? What are the best methods of managing them? and How effective are such activities? Four methods of research have been used in attempting to answer these problems.

The survey—By means of questionnaires and through visitation numerous studies have been made of the percent of students who participate, the number of activities organized, the time spent on these activities, the number of activities in which pupils participate, methods of administering, how participation is controlled and stimulated, how activities are financed, how much they cost, how student government is organized, the extent of such government, and numerous other problems related to organizing and administering such activities.

Relationship studies—Attempts have been made to show to what extent, if at all, extracurriculum activities are related to such things as intelligence, school marks, success in later life, personality, age, health, and self support. Some of the studies are based upon opinion; some show comparison without a control group; others use the control group but merely report medians for both groups; and others use the simple correlation technic whereby various factors are measured and correlated with the extent to which pupils have engaged in extracurriculum activities. Seldom is anything reported other than the degree of relationship. Cause and effect relations are generally ignored.

Evaluation of activities—The methods used are almost exclusively judgments or opinions of various groups of individuals. Judgments have been secured from school principals, those responsible for administering the activities, those who are actually participating in them, former students, and alumni. A few studies attempt to evaluate such activities by showing their effect upon scholarship and upon the success of students in after life. The factors which affect scholarship and success in after life, however, are so numerous and intricately related that it is very difficult to be sure that cause and effect relationships exist even when a high relationship exists. To date we have very little objective evidence of the worthwhileness of these activities.

Adjustments and Classification

This topic includes ability sectioning into bright, average and slow groups, honor courses, individual instruction, and special remedial instruction; on the college level it includes in addition such work as is being done in the Experimental College at Wisconsin, the new Junior College at Minnesota, the reorganization at Chicago, the new curriculum at Rollins, the Bennington program, the short curriculum for superior students at Buffalo, and the Antioch program.

Common methods of research—They consist chiefly of the survey to determine extent and methods of organization and administration; to determine its effectiveness as shown by the opinions of those working with the various methods, by the change which takes place in the number of failures, and by the improvement which takes place in the school marks received.

Experimental research—This method has had entirely too limited a use. There are a few studies of this type, however, where both experimental and control groups have been set up. In the few researches of this type, attempts have been made to control various factors by equating the groups of pupils dealt with, the teaching service, the time of day instruction was received, and the course of study used. Bright children in the control and experimental sections have been compared; the children of average ability as well as children of inferior ability have likewise been compared; thus data are being assembled regarding not only the effect of various adjustment procedures upon the group as a whole but upon children of varying degrees of academic ability.

Research needed—The single greatest need is undoubtedly for objective data concerning the effectiveness of the numerous plans and methods of caring for individual differences. In the development of such plans and methods there are in general two broad steps; theory points to methods that ought to be effective; research is then needed in order to properly evaluate the proposed methods. Thus far we have largely been content to stop with the first step; at least if any attempt has been made to evaluate effectiveness, it has been too subjective; research to secure objective evidence has been largely ignored.

Special Schools and Classes

When individual differences are so great that they can not be cared for in the regular class organization, special schools and classes have to be organized. The children who attend are called exceptional because they deviate so greatly from the normal child; this whole program of special classes and schools is now generally referred to as special education; this educational program is organized to care for three types of exceptional children, (a) the socially, (b) the physically, and (c) the mentally exceptional.

Types of research—This field has an abundance of research of the historical and survey types. Studies have been made of the development and

present status of special education for the delinquent, cripple, blind, deaf, speech defective, subnormal, and gifted.

The causes of many of these exceptional conditions, however, and the effectiveness of the programs devised to care for them have not been so thoroughly investigated. The case study method was used with considerable effectiveness by Healy (167) in the study of causes of delinquency; Slawson (169) used the correlation technic in making a similar study. We need further careful study as to the causes of all such exceptional conditions among children.

Careful objective data bearing upon the degree of effectiveness of a special education program for each type of exceptional child are rarely had. We have many opinions but objective experimental evidence is lacking. Even the follow-up case study method for determining effectiveness by studying the degree to which these pupils adjust to society and become able to maintain themselves after leaving school are scarce, due usually to lack of funds.

Summary of Needs in Research

Fundamental to research of all types is the need for uniformity in terminology. As long as such items as a day of attendance or enrolment are not agreed upon generally, how can we expect much headway to be made in needed researches? Along with uniformity in definition we need uniformity in the fundamental records kept and reports used if we are to have at hand data to be used in extensive research. Not all data can be recorded and reported which will meet the needs of all research problems; some data will always remain to be gathered at the time of making the research. Uniform records and reports will, however, make possible a continuous and up-to-date picture of current school practice which is so necessary if progress is to be made in those practices without undue delay and inefficiency.

Historical studies—As indicated before, many of these have been made. There are still great gaps in our knowledge of the historical development of the various phases of pupil personnel work. We have the major data concerning the passage of legislation in many countries; there is only meager evidence concerning the nature of whatever propaganda or educational program was used which preceded and made possible any particular legislation. We know so little about specific influences, personal or otherwise, which made possible the passage of the legislation. Such data for each state and each country would be valuable and interesting.

The survey—This type of research into present status has followed in general three technics. It has utilized the questionnaire, it has made use of the literature of the field, and it has sent individuals into the field to gather facts first hand. The studies, while numerous, are deficient in two respects. We still need extensive surveys which will show practices for the country as a whole, instead of showing practices for limited sections, and which

will be comprehensive enough to be typical of the general situation. We also need, through first hand contact, a study of typical communities and an analysis showing what seems to be the best practices in these communities. These personal studies will make possible a detailed reproduction of ways of administering and methods of organizing which can rarely be gotten by the questionnaire survey; this reproduction of best practice will make possible a vitalizing of similar work in systems which are unable to send representatives to visit cities where these *best* practices are in operation.

Statistical research—We have a few studies of causes of non-attendance and delinquency which have utilized the correlation technic; these studies, however, have been few and far between. This scarcity has undoubtedly been due to the difficulties involved; the process is not only long and tedious but means of measuring many of the vital factors are scarce, and, where available, difficult to apply.

If the determination of causes of non-attendance, failure, delinquency, and all types of exceptional conditions of children is to be made more objective, we must give more attention to this research technic. Such a technic demands immediate research into the means of measuring such factors as home conditions, teaching ability, neighborhood conditions, as well as many other factors which play a part in influencing the child. Objective means of measuring these factors will make possible a wide application of this method of research to pupil personnel problems.

Experimental research—Research of this type is greatly needed and is exceedingly scarce. The difficulty involved in conducting such research is undoubtedly the cause of this scarcity. School administrators dislike to rearrange their school organization to the extent necessary to provide the needed control groups; administratively the establishment of control and experimental groups takes unusual care, and routine procedures can not be applied.

If, however, we are to determine the value of current school practices as compared to the value of newer proposals, we must be able to make comparisons in such a way that all conditions will be identical for the two groups, except the one condition which we are studying. Then upon the basis of the measurement of results we can hope to discover which practice is the better. Studies of this type are hindered, further, due to deficient measures of achievement and to disagreement as to the factors to be measured.

The case study method—While research of this kind is relatively rare it points in the direction of the most productive immediate research in pupil personnel, guidance, and counseling. There are two problems which students of this field face continuously; one asks *why does this condition exist?*; the other asks *just how effective have these procedures been in bettering conditions?* The statistical and experimental methods, as we have just seen, suffer at present many handicaps. The past decade, however, has taught us a great deal about the possibilities of the case study technic. It is par-

ticularly applicable to the study of causes of non-attendance, failure, and delinquency. We know that the causes of these conditions are all interwoven and closely related. Each child is a case unto himself; no two children have reached the same status from the operation of identical causes in the same proportions.

The case study method is likewise applicable to any study of the effectiveness of given procedures upon the child. Do farm schools eliminate delinquency? Does the state school for the blind make acceptable citizens? One might continue to enumerate at great length some of the problems to which we need answers. The case study method should be used much more widely than in the past; it can be used effectively at present by those trained in its use. It is to be hoped that funds will be made available so that our schools can more readily evaluate their own procedures and so that, through a better understanding of causes of non-attendance, failure, and delinquency, they can eradicate these causes and thus prevent the development of problem children.

CHAPTER XI

Methods and Materials of Legal Research

THE law may be regarded as a body of authoritative rules and principles governing social relationships. These rules and principles constitute law by virtue of the fact that they have the sanction of the state behind them. They are established as law by adoption of constitutions, by enactments of legislative bodies, by court decisions, and by rulings and opinions of administrative boards and officers. To the layman the law is something more or less definite and specific; to the professional lawyer or the research worker in the field of law, it often seems indefinite, uncertain, elusive. One reason for this indefinite character of the law is that, in part at least, it represents an attempt to apply the principles of good conscience, equity, and fair dealing to problems growing out of social relationships. The shifting character of these relationships is reflected in the character of the law itself. To be sure, constitutional provisions and statutory enactments may be, and usually are, specific and definite. But even so, they cannot establish specific rules covering the whole field of human behavior. Necessarily, the courts must establish a body of principles by which they may decide cases brought before them for decision. It is this body of the law which is most uncertain and elusive.

Enough has been said to indicate that the law, by its very nature, is necessarily indefinite. The difficulty in ascertaining what the law really is is increased by the fact that the rules and principles which constitute it are, for any particular state, scattered through some hundreds of volumes and, for the country as a whole, through several thousands of volumes. Obviously, those engaged in legal research are not only confronted with the problem of documentary interpretation but with the almost equally difficult problem of locating the particular documents which embody the rules and principles relating to the problem in hand.

Classification of the Law

For purposes of this discussion, the law may be classified into two main divisions: (a) statutory law and (b) case or common law. Failure to distinguish between these two classes of law not infrequently leads to erroneous conclusions of a serious nature. Statutory law includes both constitutional provisions and statutory enactments; the case or common law includes those principles which the courts have applied in deciding issues not governed by specific constitutional provisions or statutory enactments. Perhaps the following illustration may serve to make the distinction clear. Suppose that the constitution or the statutes of a state provide that school districts shall be liable for accidents to pupils while under the jurisdiction of the school authorities. A case comes into the court involving the liability of a school district for injuries sustained by a pupil while attending school. The court has no choice in the matter; it merely applies a clearly expressed

rule of the statutes and holds the district liable. But suppose there is nothing in the statutes governing the case. Then the court bases its decision on what it deems to be sound principles of public policy. The principle adopted by the court constitutes a common-law principle for that jurisdiction.

Location and Interpretation of Statutory Law

Federal and state constitutions—There are two compilations of constitutions and other organic laws which are indispensable for any type of historical investigation involving the use of the exact text of the federal constitution or of the constitutions of the several states. In 1909 Thorpe (187) compiled and edited the texts of all organic laws adopted prior to that date. Kettleborough's *State Constitutions* (184), published in 1918, supplements Thorpe's work. The two compilations furnish the investigator with the texts of all constitutions and amendments thereto adopted prior to 1917. Recent and current constitutional provisions may be found in the revised statutes, annotated statutes, compiled statutes, or codes of the various states.

The courts are, of course, called upon from time to time to construe constitutional provisions. To determine what construction the courts have given any particular provision of a constitution, one should consult the cases digested in the American Digest System (172, 173, 174, 175, 176, 177) under the topic "Constitutional Law." Perhaps it would be better, however, to consult the annotated statutes of the jurisdiction involved or to make use of Shepard's Citations (186). The use of the Digest System and of Shepard's Citations will be discussed in some detail later. For the investigator who is interested in arriving at an understanding of the social and economic forces out of which constitutional provisions developed, the debates and proceedings of constitutional conventions constitute a mine of information.

Federal and state statutes—The investigator who is interested in tracing the history of federal legislation will find all the acts of Congress in the United States Statutes at Large. These are published at the close of each Congress and constitute a chronological collection of federal statutes. From time to time compilations of federal statutes in force have been published. The United States Revised Statutes published in 1875 contain statutes in force December 1, 1873. Two supplementary volumes were issued for the periods 1874-91, and 1892-1901. The Code of the Laws of the United States, published in 1926 under the authority of Congress, contains all general laws in force as of December 7, 1925. Provision has been made by Congress for cumulative supplements. The investigator who is interested only in laws in force or in current or recent federal legislation will find more useful the United States Code Annotated. This collection is kept up to date by annual cumulative pocket supplements.

At the end of each session of a state legislature the acts passed are published and are known as session laws. After a number of years it becomes very difficult to find the statutory enactments on any given subject, for it is necessary to consult each volume of the session laws. To obviate this diffi-

culty, from time to time all the statutory enactments are consolidated or revised either by authority of the state or by some private publishing house. These compilations or revisions are known as compiled statutes, consolidated statutes, revised statutes, annotated statutes, or codes. To locate all the statutory provisions in force relating to a particular topic, one should begin with the latest compilation of the laws of the state in which one is interested. The next step is to examine the supplements, if any, to such compilation. Finally, one must examine the session laws enacted since the publication of the latest compilation or of the supplements thereto.

All compilations of statutes, regardless of the title under which they may appear, must be used with a degree of caution. Strictly speaking, the term "compiled statutes" indicates a mere compilation of the statutes without change or modification; the term "revised statutes" indicates that the laws have been to some extent rewritten or modified; the term "code" indicates that the whole body of the law has been revised or rewritten. In practice, however, these terms are not used with precision. The research worker must determine for himself the exact nature of the collection he is using. This may be done by consulting the introduction which usually indicates the scope and nature of the collection.

One who is tracing the history of legislation must be particularly careful in the use of compilations, codes, and the like. If he has examined the session laws over a period of years he may omit the examination of a mere compilation of the statutes covering these years. He cannot, however, fail to examine compilations which represent a revision or amendment of the statutes.

Naturally, statutes are drafted with a great deal of care and precision. It often happens, nevertheless, that their meaning is uncertain and that the courts are called upon to construe them. The research worker may put his own construction on a statute only to discover later that the courts have construed it differently. Exhaustive research in statutory law involves, therefore, not only a discovery of the statutes relating to the topic under investigation but a discovery as well of the interpretations which the courts have given those statutes. The annotated statutes of a state usually refer to cases in which the statutes have been construed, but Shepard's Citations constitute, as a rule, a more comprehensive guide to judicial interpretation of statutes. This series contains separate volumes for the United States, for each of the states, and for each unit of the National Reporter System. From it one may ascertain the cases in which constitutional and statutory provisions have been construed by the courts.

Location and Interpretation of Court Decisions

As has already been indicated, the courts interpret constitutional and statutory provisions and apply them to the facts of particular cases. Not infrequently, however, there is no statutory rule governing the case in hand. In such a case, the court of necessity bases its decision on the principles of the common law. The rules of the statutory law are reduced to more or less

systematic and precise authoritative statements; the principles of the common law cannot, because of their very nature, be reduced to authoritative statement with the same degree of precision and exactness. One must search for them through somewhat more than a million and a half court decisions. Obviously, it is no easy matter to locate all the cases bearing on any particular issue. In fact, one would be quite at sea trying to extract legal principles from such a multitude of cases had not the process been simplified by enterprising publishers. In the American Digest System (172, 173, 174, 175, 176, 177) will be found a digest of all decisions of American courts of authority from 1658 to date. These decisions are arranged under 412 topical headings, one of which is "Schools and School Districts." Cases on school law are grouped under numerous subtitles descriptive of the legal principles or state of facts involved. By consulting the various editions of the American Digest System, one can locate all the cases of all the courts of final jurisdiction applicable to one's state of facts or problem of investigation. Cases on each topic are arranged alphabetically by states; a short digest of each case is given both with regard to the facts and with regard to the holding of the court; and the reports in which the decision of the court may be found are cited. There is a Descriptive Word Index to the First and Second Decennial Digests; this index indicates the section or paragraph number under which cases will be found on any particular subject.

Example of Method of Finding Cases

In locating court decisions the following steps may be followed:

1. Consult Descriptive Word Index to the First and Second Decennial Digests or later digests under topic, "Schools and School Districts." Look for word descriptive of your state of facts—for example, "vaccination." Opposite the word "vaccination" will be found the number "158." This is what is known as a *key-number*; that is, it is the paragraph or section number under which are grouped under the topic "Schools and School Districts" all cases dealing with vaccination in the First, Second, and Third Decennial Digests, the Current Digests, and the Monthly Edition of the Current Digest of the American Digest System. At the beginning of each topic in the First and Second Decennial Digest reference is made to the section or paragraph number under which cases dealing with the same topic may be found in the Century Edition of the American Digest. This includes all cases decided from 1658 to 1896, inclusive. Inasmuch as uniform key-numbers were not introduced until the publication of the First Decennial Digest, it is best to begin with that digest and work forward and backward from that point.

2. After determining the key-number by consulting the Descriptive Word Index, consult the editions of the American Digest System in the following order:

- a. First Decennial Digest, Vol. 17, all cases, 1897-1906.
- b. Second Decennial Digest, Vol. 20, all cases, 1907-16.
- c. Third Decennial Digest, Vol. 24, all cases, 1916-26.
- d. Current Digest, 1926 to date.
- e. Century Edition, Vol. 43, all cases, 1658-1896.

If one is interested in the decisions of a particular state only, he may find it advisable to use the digest of the decisions of that state rather than the American Digest System.

While one may locate all the cases bearing on a particular issue by making use of the American Digest System, there are other very helpful guides to which attention should be called. In *Ruling Case Law* (185), Volume 24, under the topic "Schools," there is an extended discussion of the principles of law governing a great many practical problems of public-school organization and administration. This work selects the most important cases on a topic, indicates the weight of authority, gives the reasoning of the courts, and cites the reports in which the cases may be found. It is kept up to date by periodical supplements. *Corpus Juris* (130) is a similar but much more elaborate legal encyclopedia. Volume 56, under the topic "Schools and School Districts," contains an article of several hundred pages. Principles of law are stated concisely, and elaborate footnotes cite the cases on which the principles are based. Attention should be called, too, to the various series of annotated cases. The most important of these are *Lawyers' Reports Annotated*, *Annotated Cases*, and *American Law Reports* (178). Each of these series carries annotations varying in length from one to a hundred pages or more. These notes bring together and evaluate the cases on a great variety of issues. They are prepared by specialists and are extremely useful to the research worker in the field of the common law. There are indexes to the notes of each of the series. See the topic "Schools and School Districts."

Interpretation of Court Decisions

The research worker who undertakes to ascertain and formulate the principles of the common law is constantly confronted with the question, For what principle of law may this case be cited? In every case the decision of the court rests upon some underlying principle, the so-called *ratio decidendi* of the case. The authoritative element of the case is the principle which dictates the decision. Care must be exercised in distinguishing that portion of an opinion which is authoritative and that which is dictum. Not infrequently, a judge in giving the opinion upon which the decision of the case rests, makes statements with regard to matters not before the court for settlement. These remarks may be introduced by way of illustration, analogy, argument, or suggestion. They are not binding as precedents because they are in reality extrajudicial. Only those portions of an opinion which deal with issues before the court are authoritative. For example, if a court is reviewing a case testing the authority of a school board to suspend teachers because of marriage and the statement is made that a school board would have authority to dismiss teachers for engaging in political activities, such a statement is dictum and has only persuasive authority.

In determining the authority of a case, one must moreover, keep clearly in mind the controlling facts. When the facts in different cases are similar in some respects but unlike in others, the investigator cannot regard the cases as authority for the same legal principle unless it is certain that the differences of fact are not of such a character as to distinguish the one case

from the other. Those who have had little experience in evaluating court decisions are very likely to regard cases as identical when in reality they should be distinguished. Suppose, for example, that one is interested in the law governing the right of a school board to dismiss a woman teacher because of marriage. A case is found in which a school board dismissed a woman teacher for marriage without having reserved the right to do so in the contract. Another case is found in which a teacher was dismissed for the same cause, but in the second case the contract provided that teachers should be dismissed upon marriage. In the two cases the causes of dismissal are the same, but the facts of the two cases are materially different. The reservation in the contract of the right to dismiss for marriage is the distinguishing feature. Before a case can be considered as an authority for another state of facts, the facts in the two cases must be sufficiently similar to warrant the application of the same legal principles.

It is more difficult, however, to identify than to distinguish cases. Facts may be widely different and yet be governed by the same principle of law. One should seek, therefore, not so much to establish identity of fact as to establish identity of principle. For example, a school board may attempt to discipline a pupil for publishing in a local newspaper an article criticizing the school board, or for being drunk on the streets, or for violating a rule prohibiting pupils from attending moving-picture shows, or for making insulting remarks to a teacher while passing him on the street. The facts in all these cases may seem widely different, but they all have one important element in common. The school board in each instance is attempting to discipline pupils for acts committed off the school grounds and out of school hours. Success in interpreting judicial decisions depends very largely on ability to distinguish cases in which the facts are very similar and to relate cases in which the facts may seem to have very little in common.

Guides to the Primary Sources of the Case Law

The following list of guides should be helpful to anyone who may be attempting to locate judicial decisions on any point of law:

I. Digests

1. The American Digest System, 1658 to date. A digest of all decisions of American courts of last resort.
 - a. Century Edition, known as the Century Digest (172). A digest of all decisions of American Courts of last resort, 1658-1896. Volume 43, topic "Schools and School Districts."
 - b. Decennial Edition, commonly known as the First Decennial Digest (174). A digest of all decisions of American courts of last resort, 1897-1906. Volume 17, topic "Schools and School Districts."
 - c. Second Decennial Edition, known as Second Decennial Digest (176). A digest of all decisions of American courts of last resort, 1907-16. Volume 20, topic "Schools and School Districts."

- d. Third Decennial Edition, known as Third Decennial Digest (177). A digest of all decisions of American courts of last resort, 1916-26. Volume 24, topic "Schools and School Districts."
 - e. American Digest, Current Digest (173). A digest of all decisions of American courts of last resort, 1926 to date. Topic, "Schools and School Districts."
 - f. American Digest, Monthly Edition. Advance sheet pamphlets giving digest of current decisions.
 - g. Descriptive Word Index (175) with supplements to date.
 - 2. State Digests. Digests of the decisions of the courts of a particular state.
- II. Encyclopedias
- 1. Ruling Case Law (185). Completed in 1920 with supplements to date. Volume 24, topic "Schools." A treatise on school law based on leading cases.
 - 2. Corpus Juris. Volume 56, topic "Schools and School Districts" (180).
- III. Indexes to Annotated Cases
- 1. Index to Notes in Lawyers' Reports Annotated, 1888-1918.
 - 2. Index to Notes in Annotated Cases, 1906-18.
 - 3. American Law Reports Cumulative Index-Digest, 1919 to date (178).
- IV. Citations
- 1. Shepard's Citations (186). Separate volumes for the courts of each state. Issued at frequent intervals. Indicates where a case has been cited by other courts and enables one to trace the history of a case and to evaluate it as of the present date.
- V. Indexes to legal periodicals
- 1. Jones' Index to Legal Periodicals, to 1899 (182, 183).
 - 2. Chipman's Index to Legal Periodical Literature, 1898-1908 (179).
 - 3. Index to Legal Periodicals, 1908 to date (181). Quarterly with annual cumulations.

CHAPTER XII

Library Methods in Educational Research

AN unfortunate misconception of library work produces pitifully small results in many educational researches. According to this view, library work consists almost wholly of routine or mechanical drudgery, to be evaded if possible, otherwise to be muddled through somehow. In reality, adequate library work is a pre-requisite and an accompaniment to practically all good educational research. The presence or absence of adequate library work here often means the difference between sound, fruitful investigation and sterile, mechanical activity masquerading under the label of research.

Place of Library Work in Educational Research

Specifically, good library work is a *sine qua non* whenever the educational researcher needs:

1. To find the problems really requiring research.
2. To secure data and information necessary to solve the problem involved. This holds for most problems in educational research.
3. To secure information necessary for interpretation of his own findings, including comparison with the findings of other researchers.
4. To find out about research methods. This covers how to isolate the particular problem, set up the research, prosecute it, interpret its results, and present them effectively. No matter how good a course in research methods he may have had previously, he has to read up again on a new problem for "to apply principles is significantly more difficult than to learn them. If teaching is necessary for the mastery of principles, it is doubly necessary for their application to practical problems" (189). After he is through the course, his learning comes from his own reading.
5. To save for the thought and interpretation aspects of a research the time and energy often wasted on the mechanics of its library phases, wasted because of sheer ignorance of how to locate library materials and how to work effectively with them.

Essentials in Library Work for Successful Educational Research

A minimum list of things in library work that the educational researcher must either know or quickly learn how to do, includes at least the following:

1. *On bibliographic work*
 - a. *How to scout* so as to get up quickly a short bibliography that will "high spot" all important phases of the whole problem, or of a section of it. This enables the researcher to keep his perspective. Without this knowledge, he can hardly escape either getting bogged down in the mass of library materials or failing to cover important phases of his study.
 - b. *How to do an exhaustive bibliography*, one as exhaustive as possible for the time spans necessarily involved in the particular research or some section of it. Without this knowledge, the researcher cannot be sure his attack is sound or know what his findings mean. *Note:* To make up either a "high spot" or an exhaustive bibliography requires a knowledge of: (1) How to draw up headings under which to look for materials. (2) The likely sources of the needed materials and data, or how to locate such sources. (3) The necessary library index tools and how to

- use them. (4) Acceptable bibliographic forms that will not interfere with arrangement in the final bibliography for publication.
- c. *How to keep the references in the bibliography organized* so that at all times throughout the research they will be accessible and useful.
 - d. *How to make up the final bibliography* to be issued with the report so that the former will be of maximum use and convenience to others.
2. *When and how to do the different kinds of reading on different phases of a research.* These include: rapid scanning of bibliographies to spot promising references; equally rapid scanning of a book or article to see if it is worth noting as a reference; rapid reading of a reference to get the run of it and to note the parts worth careful reading; and severely critical reading of important passages with due care for their setting and comparison with other documents in the same field. When and how to use sampling and short-cuts are as essential in the reading phases of a research, as in statistics.
 3. *When and how to take and use notes.* The essentials here are: when to take notes, particularly so as not to interfere with profitable reading; how to take notes; how to keep notes organized for effective and easy use at all times; and how to make the most of one's notes on library materials.
 4. *How, throughout all the library work, to save time and energy on its mechanical phases.* This releases just so much time and energy for the higher phases of the research, its thought and interpretation aspects.

Methods of Acquiring the Essentials

The first requisite is to understand that only a verbal knowledge of technics is practically worthless. A student can easily pick up such knowledge from numerous books so that he can repeat it with parrot fluency and still know little more than a parrot about how to use a library profitably. Proper practice, however, will give him an understanding of the meanings and possibilities of the library activities he pursues, and especially an ability to proceed when he has only clues instead of the plain directions and nicely solved difficulties in his library methods books. In actual library research, for every time he sees his way clear to his materials from the start, he will ten times set out with only clues.

For example, take the oft-recurring difficulty of the relative values of the book references found. Obviously, reviews of a given book afford one approach to an evaluation of it if they can but be located. On locating them, it is one thing to know that the *Book Review Digest* lives up to its name and that the *Education Index* has a section of book reviews alphabetized by authors. It is a wholly different and far superior thing to know by actual practice with a given book and reviews of it, such items as the following: the *Book Review Digest* does not include many educational books of importance; the *Education Index* did not start until 1929, cites only signed reviews, does not cover periodicals most likely to review certain kinds of educational books, and must be taken in all its cumulations for books out as much as two or three years; comparison of a book with reviews of it often shows that the reviews largely quote or paraphrase the book's estimate of itself.

The correct viewpoint about acquiring the essentials of library methods in educational research is not in itself sufficient to insure satisfactory

results. This last requires correct attitudes and activities on the part of the library and its staff, of the training institution faculty, and of the educational researcher himself. These attitudes and activities will now be discussed in detail.

Library equipment—If the library essentials in educational research are to be really acquired by the student, the library must practice what the library methods books and courses preach. This has a number of implications. Though the library possess ever so many research materials, until they are properly cataloged, they cannot be located by a researcher any more than so many needles in a haystack. Unless recent materials are promptly cataloged, the researcher cannot keep up to date in his local library. Many educational researchers require borrowing materials not possessed by the local library. But a researcher cannot find out about these latter unless the library possesses the best library tools and indexes and the library staff make all the new tools and guides available promptly. Any educational researcher needing to use files of a given periodical ought to be able to find out at once where the back volumes are indexed so he won't wade through all of them needlessly. A location guide for the particular library, to the various kinds of educational research materials, alphabetically arranged, will save educational researchers enormous amounts of time and energy.

It is highly important that the library equipment start the educational researcher off quickly with what the staff now know about bibliographies and sources on his problem. The library card catalog includes the bibliographies published in separate form possessed by the library. This, however, is only a small fraction of the bibliographies needed in educational research, many of which appear in the appendices of publications, or in periodicals. Also it does not include very short selected bibliographies of the type most useful for a student starting on a research or a new section of one, when he needs to get quickly a bird's-eye of the whole problem, or of one of its sections. Bringing together copies of the writer's *Educational Research* (188) the University of Illinois educational bibliographies, the *Research Studies* series of the United States Office of Education (190), and the files of the *Review of Educational Research*, will be better than nothing. But a far more useful thing is a card file of bibliographies and hints on sources, specifically for research purposes. At our institution we have a bibliography of bibliographies in our reference room, and a research index in the library professor's office. The former covers all subjects of interest to all students; the latter, those likely to be used by educational researchers, being particularly strong in educational administration. While there is some duplication in the two files, the research index has many notes on hints, sources, research under way, forthcoming publications and the like, not found in the other file. The research index is thus several times as large as the other file. Students using these two library aids are told that the files merely start them off with what is known by the staff and that they

are responsible for going ahead and finding whatever other research materials are needed, particularly very recent ones.

Library Staff and Attitude

For successful acquisition of the library essentials in educational research, the personnel of the library staff, and their attitude are important. In most educational researches, only clues, imperfect references, few promising leads, or overwhelming masses of materials confront the researcher at the start. The library will not possess many of the most valuable references for many studies. To give real help on such difficulties is not routine reference library service, particularly as each research is apt to call for materials very different from those needed on many other researches. This last is sure to be the case with dissertations. Such real help can come only from a regular faculty member assigned to the library for full- or part-time work. The essential is that he or she know educational research sources over a wide area, and from the viewpoint of one who has engaged in research.

The attitude of this library staff member, and indeed of all the library workers, is most important here. They should realize that for the student engaged in educational research they have a double function. First, they should furnish him promptly with all the known information, helps, and clues on his problem so he can start where those before him have left off. They need to do this with a nice discrimination, however, else they will not perform their second even greater function. This is to train him in the library phases of research so that he can carry on with a sure mastery of the essential library technic, long after he has left the library staff, and in whatever libraries are later available to him. He will never attain this mastery under their instruction if they do all the brain work involved in the library phases of his research.

Specific instruction on library phases—The items on which instruction is to be given are of less importance than the way it is given. Inexperienced researchers need instruction on many library items; even experienced ones need hints or advice on a fair number whenever they get into a new field. The main thing on instruction on sources is to be sure that the student knows how to locate the sources when he starts with only a clue or two. He does not need to remember the detailed information on the sources themselves. He does need to recall where he can find the helps to clues in books, and how he can locate the books that will give him clues on a new line of information.

Adequate instruction in library phases requires exercises that take the student into the library and force him to use his own knowledge to locate things for himself by following clues instead of simply memorizing facts about sources. If this idea is rightly presented to him, he will follow source clues with as much interest as a hunter tracks an animal or a detective finds who committed the crime. This instruction cannot be given by any amount of mere reading about it. The best motive on the part of the student comes on some research of his own, for instance, his dissertation. He will be many

times more anxious to find out sources from clues on this than he will on formal exercises that seem artificial because they must be done by many students with very diverse interests. If exercises on the student's own problem are used, there still needs to be a minimum of discussion by the instructor, much raising of problems by the student, going to library materials for the answer, and getting help on locating the materials only when he is really stumped himself. This procedure fits the student for real library situations in educational research. Note that it requires great reliance on his answering his own questions through documents that he must locate himself, and not from books on reserve as in regular classes. A library staff member assisting a research student would injure the latter if, after making available what the library had already listed for immediate use on the problem, he gave too exact references for additional sources, or brought these to the researcher with page markers in them. Only after the research student submits his proposals on sources, should the library staff member give suggestions.

Forms of instruction—A number of forms of instruction, possible in various situations, have different degrees of value on different aspects. In the most widely known form the major department offers any library instruction given. This may occur where a student assists the professor on some research of the latter. It then has all the advantages that work under a master has when the student keeps his eyes open. It does not, however, have the "drive" for the student that comes when he is working on some research of his own. The department may offer formal instruction on library phases in its departmental seminar, letting each student work on his dissertation. This gives the desired "drive" but it is likely to vary markedly in quality by departments. The history and English departments, for instance, are almost sure to have good work on library phases and many other departments likely to have poor work on them.

Another form of instruction offers definite course work in library methods for educational research. This work may be given as a section of a methods of research course, or in a separate course. It can, if it has suitable exercises, be made to focus on a student's major field, or on his own research. The latter is very difficult with students from many departments, except where a regular educational research professor specializes on library methods. This professor may give part or full time to such work.

A final form gives consultations with a staff member responsible for library phases, who knows sources as well, when the student needs it on the latter's research. This uses the correct library attitude in research, and will accomplish a great deal if there are good indexes and library tools to economize the instructor's time.¹

A minimum annotated bibliography relating to library methods and to guides to library tools and sources is listed as references nos. 191-199.

¹The forms of library instruction used in the writer's institution are described in "The Library Professor and Educational Research," by Carter Alexander, scheduled for publication in a forthcoming issue of *School and Society*.

CHAPTER XIII

The Place of Laboratory Experiment in Educational Research

The Place of Experimental Education

IN the year 1849 Horace Mann wrote a trenchant criticism of the current methods of teaching reading. He pointed out the psychological absurdity of teaching the child first the names of the letters or even the sounds of the letters. His advocacy of the word method of learning to read instituted a reform which has revolutionized modern practice. About fifty years after Horace Mann's criticism appeared, Erdmann and Dodge (208) began to study the eye movements which are involved in reading. Their first method of study was very crude. It consisted of watching the eye of the reader through a telescope. A few years later the much more accurate photographic method was applied. The photographic method has been steadily improved until now it gives a highly accurate record of the position and duration of each pause and the length and duration of each movement of the eye in reading a line of print. The study of reading by this method has led to reforms as far reaching as those which were inaugurated by Horace Mann; for example, the shift from an emphasis on oral to an emphasis on silent reading. Besides this, the technic has provided a key to the solution of a great variety of important problems. It enables us to analyze the development of reading and to describe the stages in the growth of the reading ability. It furnishes an accurate means of diagnosing the difficulties of individual children in learning to read. It is an instrument for the analysis of many special types of reading, such as reading a foreign language, reading numbers, or reading music. While Horace Mann, by a stroke of genius, was able to initiate a marked change in the method of teaching, his reform represented an isolated leap forward in a period of general stagnation. The modern experimental technic applied continuously by an army of scientific workers brings about a steady advance in teaching.

A similar conquest of the problems of learning and of teaching has been made in other subjects by means of experimentation in the educational laboratory. Notable studies have been made, for example, in the subjects of arithmetic and of handwriting. The latter subject furnishes good examples of the wasteful backing and filling which may take place in the progress of methods of teaching when practice is based upon observation and opinion alone. During the nineties the prevailing style of slanting writing was displaced by vertical writing. The arguments for vertical writing were based largely on physiological and hygienic considerations and seemed convincing to the majority of schoolmen, but no scientific methods were at hand to test the relative advantages of vertical and slanting writing, so a practical experiment was tried out on a large share of an entire generation. The trial soon revealed defects in vertical writing and it was speedily aban-

done. Its place was taken by arm movement writing taught by a highly formal drill method. Fortunately, experimental education was now ready to attack the problem. Judd's pioneer experiments (210) with the hand tracer showed that arm movement does not have the all important value which has been ascribed to it. Subsequent studies by the methods of the kymograph and the motion picture give a broad basis for a rational method of teaching. We are now (1933) brought face to face with another innovation analogous to vertical writing. Studies of this new method, manuscript writing, bid fair to enable us to appraise it fairly and to adopt whatever may be good in the new without casting aside what is valuable in the old.

The function of experimental education is, then, to appraise methods of procedure used in the school or proposed for use, to analyze the mental processes which the learner carries on or the abilities which are essential in learning, and on the basis of this analysis to discover methods of procedure which are more efficient than those which previously have been employed.

The term "experimental education" is sometimes applied chiefly or exclusively to the studies which are made for the purpose of appraisal of various methods of instruction (213). This form of investigation is commonly called classroom experimentation. Its purpose is to measure the relative effectiveness of two or more methods of instruction in the classroom. This type of study is valuable, since competent teachers frequently disagree sharply concerning the value of rival methods. Mere observation may not enable us to settle the issue. A difference of 10 or 15 percent in efficiency is important, but such a difference is difficult to determine definitely without the use of objective methods of measurement.

Notwithstanding the value of experimentation for the purpose of appraisal, it is much more limited and superficial than the experimental analysis of learning and of the abilities which underlie it. Since this kind of experimentation is commonly made in the laboratory where conditions may be controlled and suitable apparatus may be used, it may be called laboratory experimentation. The experiments in reading and handwriting which have been alluded to in the introductory paragraph were of the laboratory type. This chapter will deal with laboratory experimentation rather than with classroom experimentation.

By means of experimentation in the laboratory the activity of the learner is described in minute detail and with as much accuracy as may be possible and necessary for the purpose in hand. It is common to designate such description as objective when it is so systematized that any competent experimenter will obtain the same result. This is attained partly by defining exactly the conditions under which the experiment is carried out. It usually requires that the description be expressed in quantitative or numerical terms. It commonly requires the use of apparatus by means of which a record can be made of actions so rapid or obscure as to be difficult to detect, or involving accurate time relations.

Experimental education in the sense in which the term is used in this chapter is only one of the several scientific methods which are applied to the solution of educational problems. The place of experimental education in relation to the scheme of education may best be shown by presenting the various aspects of education in tabular form. This is done in the following outline:

1. Learning. The central and primary element in the whole scheme of education. For the promotion of learning all the paraphernalia of education exist. Learning may for convenience be divided into general and special forms of learning. The special forms of learning are presented in learning the various school subjects. Experimental education is concerned chiefly with the analysis of these general and special forms of learning.
2. The nature and capacities of the child. This includes studies of the child's mental nature and capabilities and parallel studies of his physical nature and capabilities. The studies deal with the following special problems:
 - Development with age: capacities, abilities, and interests at succeeding ages.
 - Health and its conditions (both mental and physical).
 - Individual differences, normal and abnormal, measured by the use of mental and physical tests.

Some of these problems require laboratory experimentation and may be included in the sphere of experimental education. This may be true, for example, of the discovery and standardization of new methods of testing.

3. The Curriculum. What is to be taught and learned. The curriculum is based partly on the studies referred to under the preceding heads, but direct studies of the curriculum have usually consisted of surveys of the social demand for given types of learning. These are not included in experimental education.
4. Testing the results of learning and of teaching. The development of new methods of testing may involve experimental methods, but the application of tests for the purpose of making a survey of the results of teaching does not come within the scope of experimental education.
5. Provision of the means of learning and instruction.
 - a. Numbers and types of individuals to be taught. These facts are obtained by studies of the school population.
 - b. The means which are available to carry on education. The financial resources, as determined by taxation studies. Studies of expenditure, salaries, etc. Material equipment. Buildings. Building surveys. Construction of buildings. Personnel studies. School administration, school boards, administrative and supervisory staff, teaching staff, including preparation, promotion, and tenure.

These problems are studied for the most part by other than experimental methods, though in a few special instances experimental laboratory studies have been made upon them.

To sum up, experimental education is a form of scientific investigation which is used chiefly to attack the problems of learning and of the analysis of abilities. It is thus directed toward the study of the heart and center of all those activities which comprise our educational system. The experimental method may also be used to some extent in attacking other problems, for example, problems of health and physical well-being, or problems in the construction of school buildings. In this chapter, however, we shall confine ourselves to those phases of experimental education which are psycho-

logical in nature. Furthermore, we shall confine ourselves to laboratory experimentation rather than to classroom experimentation. Classroom experimentation is discussed in Chapter V by Monroe.

The Nature of an Experiment

In order to get a clear notion of the nature of an experiment we shall begin with an example in which the conditions approach the ideal conditions of experimentation. From such an example we can obtain a notion of the essential nature of experimentation as a scientific method. We shall afterwards consider cases in which it is necessary to compromise with the ideal method and introduce various checks and balances to compensate for the failure to observe the strict rules of experimentation.

The first example is a classical experiment of a pure type. It may be called a *crucial* experiment. In the eighteen eighties, the French biologist Pasteur was led by his previous investigations to the belief that the disease anthrax, which existed in cattle, was due to a specific form of bacteria and that it was possible to make cattle immune from the disease by inoculation with a serum. His belief was not shared by his fellow scientists, however, and so he set up a crucial experiment, one which would definitely settle the issue if the results came out in accordance with Pasteur's hypothesis. A herd of cattle was divided into two groups. Those of one group were given the inoculation which was intended to make them immune from anthrax. The other group was not immunized. Then all the cows of both groups were exposed to the disease. None of the immunized cows took the disease, while many of those which were not immunized did take it. Thus, Pasteur's hypothesis was verified.

The conclusion drawn from this experiment is that inoculation immunizes cattle from anthrax. This conclusion stands because the animals which did not take the disease were inoculated and because this inoculation was the only factor which could account for their immunity. This only factor is technically named the *single variable*, and the rule of experimentation is that only a single variable shall be introduced into the situation. The purpose of the exposure of the other group of cows which had not been inoculated was to make sure that no other variable was introduced. For example, the herd of cows may have been immune from some other cause or the exposure of the disease may not have been potent. The fact that they took the disease showed that it was the inoculation which rendered the one group immune, since this was the only respect in which they differed from the other. Inoculation was a single variable.

An example from the field of educational psychology will reveal further the important conditions of an experiment. In 1904 Ebert and Meumann (207) made a study of the effect of practice in memorizing one sort of material on the ability to memorize other sorts of material. In other words, they set out to measure the transfer of training from one field of memory to another. To a group of persons they first gave an elaborate series of tests of memory for various kinds of material. They then gave several weeks of

practice memorizing nonsense syllables. At the end of this practice they again gave them the initial tests. They found that they had gained materially in their average score on these tests, and attributed this gain to the effect of the intervening practice on different kind of material which they believed had increased their general power of memory.

Doubt arose in the minds of subsequent investigators whether Ebert and Meumann had succeeded in isolating a single variable; that is, whether another factor than the practice in the sense material might not amount for the gain in the scores on the tests. The other possible cause of the gain was thought to be the practice on the tests themselves. In order to check up on this possibility, Dearborn (204), in 1911, repeated Ebert and Meumann's experiment, using a second or parallel group of persons in addition to the first or experimental group. To the parallel group he gave the initial and final tests without the intermediate practice. He found that this group did gain in the tests. By subtracting this gain from the total gain of the experimental group he was able to calculate that portion of their gain which was due to the practice on a different sort of material.

Another example of an experiment in which more than one variable affected the results is found in a study made by Wallin (215), to determine whether improved care of the teeth causes an increase in children's mental ability. A group of children was selected who were given all necessary dental treatment and were carefully trained in the care of their teeth for a period of six months. The children were given a series of mental tests at the beginning, middle, and end of the period. They were found to have made a large gain in the scores on these tests. No conclusion can be drawn concerning the effect of the oral hygiene on this gain, however, since at least two other factors may have produced it. One was the mental growth which accompanies increased age and the other was practice on the tests. Wallin originally planned to discount these other variables by giving the tests to a parallel group which would not be given the oral hygiene.

This simplest method of comparison with a control group is represented in the following tabular scheme:

Group x	Group y
Method 1	Method 2

This method may be refined by equalizing the groups through matching or some other procedure, as described by Monroe.

In some cases it is possible to balance the effect of irrelevant factors by a method which applies the experimental variable to both groups. This modification of the parallel group method is called the rotation method. Suppose, for example, we wish to compare the effectiveness of memorizing by two methods of learning, the whole method and the part method. If we had one group of persons memorize one selection by the whole method and then another selection by the part method their relative score by the two methods might be effected by two irrelevant factors, a difference in the diffi-

culty of the selections and a greater facility in memorizing the second selection as a result of practice. On the other hand, we might have one group of persons memorize a selection by one method and a second group memorize the same selection by the other method. In such a case neither the difficulty of the selection nor the practice effect would be a variable. But another variable would be introduced, namely the difference in the ability of the two groups of learners.

The difficulty is overcome by letting both groups memorize by both methods, one starting with Selection A and memorizing by the part method, then memorizing Selection B by the whole method, the other starting with Selection A but using the whole method and then memorizing Selection B by the part method. The rotation scheme may be illustrated by the following table:

	<i>First learning</i>	<i>Second learning</i>
	<i>Selection A</i>	<i>Selection B</i>
Method 1	Group x	Group y
Method 2	Group y	Group x

It will be seen that both groups of learners use both methods. Therefore, the comparative score by the two methods will not be affected by any difference in their ability. Again, both selections are learned by both methods. Hence, the relative score will not be affected by this variable. Finally, one group uses Method 1 first and the other uses Method 2 first, and the two methods will profit equally by the effect of practice. Thus, the rotation method isolates one variable by balancing the other variables against each other.

The methods which have just been described characterize the experimental method of procedure when some factor or variable has been discovered and the purpose of the experiment is to measure the result of the introduction of this variable into a given situation. This is a relatively simple form of experimentation, and the methods of procedure which govern it are comparatively easy to set forth and to follow. Not all forms of experimentation are like these, however. In fact, they are the least important. They represent a stage of experimentation in which the problem has been rather completely analyzed and in which the methods of measurement have been well worked out.

If we consider again Pasteur's crucial experiment we shall see on a moment's consideration that it constituted the last step in a long series of investigations. The previous studies led him to the *discovery* of bacteria, of their agency in disease, and of the method of inoculation. This discovery was the important part of Pasteur's work and the part which required genius to perform. The proof of what he had discovered could have been carried on by any routine technician. The discovery, furthermore, was made in the course of a long process of trial and error, of trial leading to hypothesis, and hypothesis followed by further trial. Because the rules for

the experiment of discovery cannot be formulated so definitely as can those for the experiment of proof or verification is no reason for neglecting the more difficult type of experiment. While such definite rules cannot be laid down, some of the chief characteristics may be outlined.

The experiment of analysis and discovery begins with a less definite and clearly formulated aim than does the experiment of proof or the crucial experiment. The series of experiments on reading illustrate this fact. At the outset the aim was hardly more definite than to discover how the eye behaves in reading. After the general facts concerning the eye movements were discovered, certain more specific questions emerged, such as, How do individuals differ in their eye movements? How do the eye movements develop with age? What is the relation between eye movements and efficiency in reading? What is the relation between the eye movements and pronunciation in oral reading? How are the eye movements affected by the subject-matter and by mechanical features, such as size of type and length of line?

The development of a problem may again be illustrated by Bryan and Harter's two experiments (201, 202) on learning the telegraphic language. In the first experiment these investigators discovered that the learning curve for sending a message differed in form from the learning curve for receiving a message. In the middle of the receiving curve they found a level stretch representing a period of little progress. The second experiment was made to ascertain the meaning of this level stretch or plateau. To do so the experimenters analyzed the process of receiving into three processes of receiving isolated letters, unrelated words, and connected discourse. This further analysis revealed the fact that the plateau occurred only in the curve for connected discourse. The course of experimentation, then, represents a progressive advance in which the problem is gradually analyzed and the aim becomes more and more specific.

A large share of the advance in the methods of attack on a particular problem is to be attributed to the development of more and more accurate and appropriate technic of recording or of measurement. In laboratory work this consists largely in the invention of better forms of apparatus. The investigations of both handwriting and reading furnish good illustrations of the development of better and better adapted forms of apparatus. In the study of the eye movements of reading Erdmann and Dodge (208) observed the eye through a telescope. Javal (212) placed a sound recording apparatus against the lid of the partly closed eye and counted the impulses made by the eye movements. Ahrens (200) placed an ivory cup on the cornea to which was fastened a light bristle marking on a piece of smoke paper. Dearborn (205) photographed on a falling plate a beam of light reflected from the cornea by a method invented by Dodge. Buswell (203), Gray (209), Judd (211), and Schmidt (214) gradually elaborated the photographic method, finally using long strips of motion picture film which can be run both vertically and horizontally, thus recording the movements of the eye in any direction. To this elaborate apparatus for photographing the eye

movements, Buswell attached a dictaphone by means of which he secured parallel records of the voice and of the eye in oral reading. To the same apparatus Douglas (206) attached a device for exposing successive portions of the reading text in order to study the effect upon reading of cutting off the view of the parts of the line beyond the section the reader is directly looking at. On such development of technic depends much of the progress in experimentation.

Relation of the Experimental to the Statistical Method

During the early decades of the existence of experimental psychology the experimental method was used almost exclusively. In the period preceding 1900 it was quite common to conduct experiments with but three or four persons. In fact, in his classical experiments on Memory, Ebbinghaus employed but a single subject, himself. Following 1900, however, many investigators began to shift their method. Instead of making a very careful and intensive study of a few persons they began to study large groups of persons by much less intensive methods. This large-scale method was fostered by Karl Pearson in England and by Cattell and Thorndike in America. At the same time the experimental method was being applied to educational problems by those who followed the traditions of the psychological laboratory of Wilhelm Wundt, notably by Judd. We have now to consider the relations of these two methods.

The experimental and the statistical method are alike in that both aim at an analysis of the facts which they study. They aim to break up the complex trains of events into their elements and then to study the relationship of these elements to one another. Their difference lies in the method by which the analysis is made.

The contrast in method may be illustrated from the study of the problem of nature and nurture. We find large individual differences to exist in the abilities of children as measured by the scores on mental tests. Some have interpreted these differences as due almost entirely to differences in nature capacity, while others ascribe them in considerable degree to the effect of the home, the school, and other features of the environment. If the environment is an important cause of differences in mental ability then differences in one will be associated with differences in the other. The first purely statistical procedure which suggests itself is to compare the environment of a large number of children with their scores on a mental test. The method by which such a comparison is made is called correlation. But a simple correlation of this sort will not reveal directly the relation between environment and ability, since children who are in superior homes also in general have superior parents. Thus their superior mental ability might be ascribed to either fact or to both. A purely statistical method of analysis would consist in selecting from the entire group all those children whose parents are of a given degree of ability and then comparing the variations in the ability of these children with the variations in their environment. The same

comparison could be made in the case of children of parents at each level of ability. In each case the differences in the children might be ascribed to environment since heredity would be uniform. Putting together the results of all these comparisons we could ascertain the effect of environment when heredity is constant. This is in effect what is done by the method of partial correlation.

An experimental procedure would be to take a group of infants from a poor environment, place half of them in very poor homes, and the other half in very good homes, and measure their mental ability at regular intervals. If the children placed in good homes turned out to be superior to those placed in poor homes, their superiority could be ascribed to the effect of the better environment.

Both methods of investigation consist in making an analysis. Both, that is, have attempted to separate the effect of heredity from the effect of environment. In the statistical method the separation is made after the fact. It is done by grouping cases and by making comparisons among them, drawing inferences as to how causes are related to effects. In the experimental method the factors are separated at the outset. The factor which we wish to study is brought to bear upon an individual or a group of individuals independently of other factors which might conceivably affect the results. By the experimental method a study is made of events succeeding one another in time, while by the statistical method a study is more commonly made of relationships between events co-existing at the same time. The relation between the cause and the effect is more direct than when the analysis is made by the statistical method.

While the experimental method gives the more conclusive evidence concerning cause and effect relations, the statistical method is sometimes chosen in preference to the experimental method because it gives quicker returns. As in the example of the study of foster children there are many cases in which a statistical study can be made in the course of a year or so, while an experimental study would require a period of ten years or more. In other cases the difference between the two methods would be not so much one of the total duration of the investigation, as of the time and energy necessary in gathering the data. The experimental method is the more expensive and is, therefore, often avoided in favor of the statistical method.

While the experimental method might give more direct and conclusive evidence than the statistical method, it is sometimes in the nature of the case very difficult, if not impossible to apply. For example, we cannot well conduct experiments in human heredity. Such experiments can be made with plants and animals with enormous profit, as in the case of Mendel's studies with peas, but human matings must be left to the choice of the individuals concerned. In such cases we must resort to the statistical method.

On the other hand, there are some problems which can be investigated only by the experimental method. These are the problems which require laboratory technic in order to obtain the very facts we wish to study. It

would not be possible to study the relationship of eye movements in reading to speed and comprehension, for example, without the use of special laboratory methods of recording the eye movements. Similarly, it would not be possible to study the relationship of minute changes in the speed of the writing movement to other facts of writing unless we had means of measuring these speed changes far superior to unaided observation.

It appears, then, that there is a class of problems which can be studied only by the statistical method, another class which can be studied only by the experimental method, and a third class which may be studied by either method. The choice between the two methods, when either may be used, will be determined by considerations of convenience and of expense. In many cases it is of advantage to make a preliminary investigation by the statistical method and follow this up by an experimental study. The statistical investigation serves to raise important problems and sometimes to suggest hypotheses for the explanation of the facts which are revealed. The experimental study may shed further light on the correctness of their hypotheses.

In the foregoing discussion the statistical and experimental methods have been set forth as contrasting methods of investigation. This is not the whole truth. They are also frequently used in combination with others. In fact, some form of statistical treatment is usually given to the data which are gathered in an experiment. An experiment could be made to consist of a single trial with a single individual. For example, if we moved a light across an infant's field of vision and his eyes followed the light the event would demonstrate that the child's ocular control was developed to the extent of making such a coordination possible. An experimental fact can be established without a multiplicity of cases.

However, the multiplication of trials yields important facts which a single trial cannot give. One type of multiplication consists in the repetition of the procedure with the same individual. If a stimulus is followed by the same response several times in succession we are justified in believing more strongly that the stimulus causes the response than if the sequence occurred only once. A single case might be a coincidence. Again, the response may vary from time to time in its extent or in the manner of its performance. Or a variation in the intensity of the stimulus may cause a variation in the response. Or a stimulus of a given intensity may sometimes produce the response and sometimes not. Or the subsequent response may differ progressively from the first response. That is, a practice effect may appear. Finally, repeated trials may reveal, not a variation in the response of the subject, but a variation in the measurement or recording of the response. These variations may be treated statistically as errors and an estimate may be made of the true response.

A second way in which the experimental trials are multiplied consists in repeating the experiment with a number of different individuals. This is done primarily to discover the characteristic differences in the reactions of

different persons. In the early period of experimental psychology very little attention was paid to individual differences. They were thought of largely as disturbing errors. The variations were disregarded in favor of the average performance or the common performance of the group of persons who took part in the experiment. The aim was to discover laws of behavior which are characteristic of people in general. This is still the aim of the major part of our experimentation. But we now recognize that there are real differences in the way different persons behave and in their capacity for learning. Hence, even if our aim were only to discover the general laws which apply to all persons, it would be necessary to determine what the real differences between persons are so that we can make allowances for them and discover the essential similarities behind them. The prevailing practice is now to carry on an experiment with a number of persons, in order, first, to discover and measure the real individual differences which may exist and, second, by making allowance for the individual differences, to discover the general laws which govern the behavior of persons in general.

The student of experimental education, then, must make constant use of at least the simpler methods of statistical analysis and summarization of his data. We may include under this head any form of graphic representation which will reveal important relationships.

Summary

Analytical experimentation of the laboratory type has been applied successfully in attacking educational problems, particularly in the field of learning and the psychology of the school subjects. It is also applicable in the attack on other problems, particularly those in which the aim is to discover a causal relation. The method is laborious but relatively conclusive in its findings. It may often be pursued in combination with the statistical method. It is correlative with the statistical method, each method being especially suited for the study of a given class of problems.

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